SOUTH KINGSTOWN
Public Schools

SOUTH KINGSTOWN
SCHOOL DISTRICT

307 Curtis Corner Road,

Wakefield, RI 02879

General Outline Specifications

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END OF SECTION 00 01 10

SECTION 01 10 00
SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: North Providence School Department Generic Specification.

B. Owner's Name: North Providence School Department.

C. Architect's Name: StudioJAED Architects & Engineers.

D. The Project consists of construction of a new school building and/or renovations.

1.02 CONTRACT DESCRIPTION

A. Contract Type: Construction Manager at Risk

1.03 DESCRIPTION OF WORK

A. Scope of work is as indicated on the drawings and as noted below:
   1. Construction of a new school building, demolition of the existing school building following construction, and associated site work..

1.04 ADDITIONAL PROJECT REQUIREMENTS

A. The Contractor is responsible for all required applications, reivews, permits, and associated fees. All fees shall be included in the Contractor's bid proposal.

B. The Contractor is responsible for locating underground utilities in the area of demolition and construction, including, but not limited to, electromagnetic survey, ground penetrating rader, exploratory excavaion. All costs shall be included in the Contractor's bid proposal.

C. The Contractor shall include an Owner's Contingency Allowance as specified in Section 01 21 00. The Allowance shall be included in the Contractor's bid proposal.

1.05 WORK BY OWNER

A. Owner reserves the right to complete work or award separate contracts for work in and around the work area during this contract.

1.06 CONCURRENT WORK

A. The following work will be completed concurrently with this contract.
   1. None

1.07 OWNER OCCUPANCY

A. North Providence School Department intends to continue to occupy adjacent portions of the existing building during the entire construction period.

B. Cooperate with North Providence School Department to minimize conflict and to facilitate North Providence School Department's operations.

C. Schedule the Work to accommodate North Providence School Department occupancy.

1.08 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.
   1. Locate and conduct construction activities in ways that will limit disturbance to site.

B. Arrange use of site and premises to allow:
   1. North Providence School Department occupancy.
   2. Work by Others.
   3. Use of site and premises by the public.

C. Provide access to and from site as required by law and by North Providence School Department:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.

2. Do not obstruct roadways, sidewalks, or other public ways without permit.

D. Contractor shall be required to provide temporary sanitary facilities.

E. Existing building spaces may not be used for storage.

F. Time Restrictions:
   1. Days/Hours of construction shall be limited to Monday thru Friday, 7:00 am to 5:00 pm. Work outside of these hours must be coordinated in advance with the School and the School Department.

G. Utility Outages and Shutdown:
   1. Limit disruption of utility services to hours the building is unoccupied.
   2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to North Providence School Department and authorities having jurisdiction.
   3. Prevent accidental disruption of utility services to other facilities.

1.09 WORK SEQUENCE

A. Coordinate construction schedule and operations with North Providence School Department.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 10 00

SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 REFER TO CONSTRUCTION MANAGER'S FRONT END SPECIFICATIONS FOR PRICE AND PAYMENT PROCEDURES

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 20 00

SECTION 01 21 00

ALLOWANCES

PART 1 GENERAL

1.01 REFER TO CONSTRUCTION MANAGER'S BID PACKAGES FOR ANY REQUIRED ALLOWANCES

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 21 00

SECTION 01 22 00

UNIT PRICES

PART 1 GENERAL

1.01 REFER TO CONSTRUCTION MANAGER'S BID PACKAGES FOR ANY REQUIRED UNIT PRICES

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 22 00

SECTION 01 23 00

ALTERNATES

PART 1 GENERAL

1.01 REFER TO CONSTRUCTION MANAGER'S BID PACKAGES FOR ANY REQUIRED ALTERNATES

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 23 00

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preconstruction meeting.

B. Site mobilization meeting.

C. Progress meetings.

D. Construction progress schedule.

E. Coordination drawings.

F. Submittals for review, information, and project closeout.

G. Number of copies of submittals.

H. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 01 70 00 - Execution and Closeout Requirements: Additional coordination requirements.

B. Section 01 78 00 - Closeout Submittals: Project record documents.

1.03 PROJECT COORDINATION

A. Project Coordinator: The Owner's Representative.

B. Cooperate with the Project Coordinator in allocation of mobilization areas of site.

C. During construction, coordinate use of site and facilities through the Project Coordinator.

D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities.

F. Make the following types of submittals to StudioJAED through the Project Coordinator:
   1. Requests for interpretation.
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Coordination drawings.
   7. Closeout submittals.

PART 3 EXECUTION

2.01 PRECONSTRUCTION MEETING

A. The Owner's Representative will schedule a meeting after Notice of Award.

B. Attendance Required:
   1. Contractor.
   2. Owner's Representative.

C. Agenda:
   1. Execution of North Providence School Department-Owners Project Manager Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
   5. Designation of personnel representing the parties to Contract, and StudioJAED.

6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
7. Scheduling.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to the Owner, participants, and those affected by decisions made.

2.02 SITE MOBILIZATION MEETING

A. The General Contractor will schedule a meeting at the Project Site prior to Contractor occupancy.

B. Attendance Required:
1. Owners Project Manager.
2. StudioJAED.
3. North Providence School Department
4. Owners Project Manager's Superintendent.
5. Owner's Representative.

C. Agenda:
1. Use of premises by Owner and Contractor.
2. Owner's requirements and occupancy prior to completion.
3. Construction facilities and controls.
4. Temporary utilities.
5. Survey and building layout.
6. Security and housekeeping procedures.
7. Schedules.
8. Application for payment procedures.
9. Procedures for testing.
10. Procedures for maintaining record documents.
11. Requirements for start-up of equipment.
12. Inspection and acceptance of equipment put into service during construction period.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Owner, participants, and those affected by decisions made.

2.03 PROGRESS MEETINGS

A. The General Contractor will schedule and administer meetings throughout progress of the Work at minimum bi-monthly intervals.

B. The General Contractor will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, StudioJAED, as appropriate to agenda topics for each meeting.

D. Agenda:
1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Maintenance of progress schedule.
7. Corrective measures to regain projected schedules.
8. Planned progress during succeeding work period.
9. Maintenance of quality and work standards.
10. Effect of proposed changes on progress schedule and coordination.
11. Other business relating to Work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Owner, participants, and those affected by decisions made.

2.04 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 30 days of Work, with a general outline for remainder of Work.

B. If preliminary schedule requires revision after review, submit revised schedule within 5 days.

C. Within 10 days after review of preliminary schedule, submit draft of proposed complete schedule for review.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

2.05 COORDINATION DRAWINGS

A. Provide information required by Owner's Representative for preparation of coordination drawings.

B. Review drawings prior to submission to StudioJAED.

2.06 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.

B. Submit to StudioJAED for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

C. Samples will be reviewed only for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

2.07 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Certificates.
   3. Test reports.
   4. Inspection reports.
   5. Manufacturer's instructions.
   6. Manufacturer's field reports.
   7. NECHPS DATA.
   8. Other types indicated.

B. Submit for StudioJAED's knowledge as contract administrator or for Owner. No action will be taken.

2.08 SUBMITTALS FOR PROJECT CLOSEOUT

A. When the following are specified in individual sections, submit them at project closeout:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Other types as indicated.

B. Submit for Owner\s benefit during and after project completion.

2.09 NUMBER OF COPIES OF SUBMITTALS

A. Documents for Review:
   1. Small Size Sheets, Not Larger Than 8-1/2 x 11 inches: Submit the number of copies that Contractor requires, plus three that will be retained by StudioJAED.

2. Larger Sheets, Not Larger Than 36 x 48 inches: Submit the number of opaque reproductions that Contractor requires, plus three that will be retained by StudioJAED.

B. Documents for Information: Submit three.

C. Samples: Submit the number specified in individual specification sections; one of which will be retained by StudioJAED.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

2.10 SUBMITTAL PROCEDURES

A. Transmittal Form: AIA Form G810.

B. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.

C. Identify Project, Owners Project Manager, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.

D. Apply Owners Project Manager's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.

E. Deliver submittals to Architect at business address.

F. Schedule submittals to expedite the Project, and coordinate submission of related items.

G. For each submittal for review, allow 15 days excluding delivery time to and from the Owners Project Manager.

H. Provide space for Contractor and StudioJAED's review stamps.

I. When revised for resubmission, identify all changes made since previous submission.

J. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

K. Submittals not requested will not be recognized or processed.

END OF SECTION 01 30 00

SECTION 01 35 53
SECURITY PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Security measures including formal security program, entry control, personnel identification, and miscellaneous restrictions.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: use of premises and occupancy.

B. Section 01 50 00 - Temporary Facilities and Controls: Temporary lighting and barriers and enclosures.

1.03 SECURITY PROGRAM

A. Protect Work, existing premises and North Providence School Department's operations from theft, vandalism, and unauthorized entry.

B. Initiate program at project mobilization.

C. Initiate program in coordination with North Providence School Department's existing security system at project mobilization.

D. Maintain program throughout construction period until North Providence School Department acceptance precludes the need for Owners Project Manager security.

E. Maintain program throughout construction period until directed by Architect.

1.04 ENTRY CONTROL

A. Restrict entrance of persons and vehicles into Project site and existing facilities.

B. Allow entrance only to authorized persons with proper identification.

C. North Providence School Department will control entrance of persons and vehicles related to North Providence School Department's operations.

1.05 PERSONNEL IDENTIFICATION

A. Provide identification badge to each person authorized to enter premises.

B. Badge To Include: Personal photograph, name, expiration date and employer.

C. Maintain a list of accredited persons, submit copy to North Providence School Department on request.

D. Require return of badges at expiration of their employment on the Work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 35 53

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. References and standards.

B. Quality assurance submittals.

C. Control of installation.

D. Tolerances.

E. Manufacturers' field services.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittal procedures.

B. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

1.03 REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants.

B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation.

C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry.

D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Design Data: Submit for Architect's knowledge as contract administrator or for the North Providence School Department, for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

C. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Owner.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of test/inspection.
      h. Date of test/inspection.
      i. Results of test/inspection.
      j. Conformance with Contract Documents.
      k. When requested by Architect, provide interpretation of results.
   2. Test reports are submitted for Architect's knowledge as contract administrator or for the North Providence School Department, for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

D. Certificates: When specified in individual specification sections, submit certification by the manufacturer or installation/application subcontractor to Architect, in quantities specified for Product Data.
   1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
   2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the North Providence School Department's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

F. Manufacturer's Field Reports: Submit reports for StudioJAED's benefit as contract administrator or for North Providence School Department.
   1. Submit report in duplicate within 30 days of observation to Architect and Owner for information.
   2. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

G. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for North Providence School Department.
   1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.
   2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or North Providence School Department.

1.05 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard of date of issue current on date of Agreement, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have Work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.03 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Architect 30 days in advance of required observations.
   1. Observer subject to approval of Architect.
   2. Observer subject to approval of North Providence School Department.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.04 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION 01 40 00

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary sanitary facilities.

B. Temporary Controls: Barriers, enclosures, and fencing.

C. Security requirements.

D. Vehicular access and parking.

E. Waste removal facilities and services.

1.02 RELATED REQUIREMENTS

A. Section 01 35 53 - Security Procedures

1.03 TEMPORARY UTILITIES

A. Provide and pay for all lighting and ventilation required for construction purposes.

B. Existing facilities may be used.

C. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.04 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization if a field office is employed.

B. Provide, maintain and pay for facsimile service to field office at time of project mobilization.

1.05 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Use of existing facilities is not permitted.

C. Maintain daily in clean and sanitary condition.

1.06 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Provide protection for plants designated to remain. Replace damaged plants.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.07 INTERIOR ENCLOSURES

A. Provide temporary partitions as indicated to separate work areas from School District-occupied areas, to prevent penetration of dust and moisture into School District-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and reinforced polyethylene; plywood; or gypsum board sheet materials with closed joints and sealed edges at intersections with existing surfaces:
   1. STC rating of 35 in accordance with ASTM E90.
   2. Maximum flame spread rating of 25 in accordance with ASTM E84.

C. Paint surfaces exposed to view from School District-occupied areas.

1.08 SECURITY - SEE SECTION 01 35 53

A. Provide security and facilities to protect Work, existing facilities, and School District's operations from unauthorized entry, vandalism, or theft.

B. Coordinate with Portsmouth School Department security program.

1.09 VEHICULAR ACCESS AND PARKING

A. Coordinate access and haul routes with governing authorities and North Providence School Department.

B. Provide and maintain access to fire hydrants, free of obstructions.

C. Provide means of removing mud from vehicle wheels before entering streets.

D. Designated existing on-site roads may be used for construction traffic.

E. Existing parking areas may not be used for construction parking.

F. No emergency egress from building may be blocked at any time.

1.10 WASTE REMOVAL

A. See Section 01 74 19 - Waste Management, for additional requirements.

B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

C. Provide containers with lids. Remove trash from site periodically.

D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.11 FIELD OFFICES

A. Office: As required by contractor.

B. Locate offices a minimum distance of 30 feet from existing structures.

1.12 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Final Application for Payment inspection.

B. Clean and repair damage caused by installation or use of temporary work.

C. Restore existing facilities used during construction to original condition.

D. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 50 00

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Transportation, handling, storage and protection.

C. Product option requirements.

D. Substitution limitations and procedures.

E. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Lists of products to be removed from existing building.

B. Section 01 40 00 - Quality Requirements: Product quality monitoring.

C. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

D. Section 01 70 00 - Execution and Closeout Requirements: Contractor Points Requirements for the North East Collaborative for High Performance Schools (NECHPS).

E. Section 01 74 19 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting packaging and substitutions.

1.03 REFERENCE STANDARDS

A. 16 CFR 260.13 - Guides for the Use of Environmental Marketing Claims; Federal Trade Commission; Recycled Content.

B. CAN/CSA Z809 - National Standard for Sustainable Forest Management; CSA International Inc.

C. NFPA 70 - National Electrical Code.

1.04 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Agreement.
   2. For products specified only by reference standards, list applicable reference standards.

B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

E. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.

B. Do not use products having any of the following characteristics:
   1. Made using or containing CFC's or HCFC's.
   2. Made of wood from newly cut old growth timber.

C. Where all other criteria are met, Owners Project Manager shall give preference to products that:
   1. Are extracted, harvested, and/or manufactured closer to the location of the project.
   2. Have longer documented life span under normal use.
   3. Result in less construction waste.
   4. Are made of vegetable materials that are rapidly renewable.

2.02 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.03 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.

B. Architect will consider requests for substitutions only within 30 days after date of Agreement.

C. Substitutions may be considered when a product becomes unavailable through no fault of the Owners Project Manager.

D. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

E. A request for substitution constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Will provide the same warranty for the substitution as for the specified product.
   3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to North Providence School Department.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.

F. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

G. Substitution Submittal Procedure:
   1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
   2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
   3. The Architect will notify Owners Project Manager in writing of decision to accept or reject request.

3.02 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

H. Comply with manufacturer's warranty conditions, if any.

I. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

J. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

K. Prevent contact with material that may cause corrosion, discoloration, or staining.

L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION 01 60 00

SECTION 01 61 16

VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for VOC-Content-Restricted products.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittal procedures.

B. Section 01 70 00 - Execution and Closeout Requirements: Contractor Points Requirements for the North East Collaborative for High Performance Schools (NECHPS).

1.03 DEFINITIONS

A. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
   1. Interior paints and coatings.
   2. Interior adhesives and sealants, including flooring adhesives.

B. Interior of Building: Anywhere inside the exterior weather barrier.

C. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.

D. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.

B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.

C. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board.

D. SCAQMD 1113 - Architectural Coatings.

E. SCAQMD 1168 - Adhesive and Sealant Applications.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

1.06 QUALITY ASSURANCE

A. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Report of laboratory testing performed in accordance with requirements.

B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.01 MATERIALS

A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.

B. VOC-Content-Restricted Products: VOC content not greater than required by the following:
   1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
   2. Joint Sealants: SCAQMD 1168 Rule.

3. Paints and Coatings: Each color; most stringent of the following:
    a. 40 CFR 59, Subpart D.
    b. SCAQMD 1113 Rule.
    c. CARB (SCM).

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. North Providence School Department reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to North Providence School Department.

B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Owners Project Manager.

END OF SECTION 01 61 16

SECTION 01 70 00

EXECUTION AND CLOSEOUT REQUIREMENTS

INCLUDING NECHPS REQUIREMENTS

PART 1 GENERAL

2.01 SECTION INCLUDES

A. Contractor Points Requirements for the North East Collaborative for High Performance Schools (NECHPS)

B. Examination, preparation, and general installation procedures.

C. Cutting and patching.

D. Surveying for laying out the work.

E. Cleaning and protection.

F. Starting of systems and equipment.

G. Demonstration and instruction of North Providence School Department personnel.

H. General requirements for maintenance service.

2.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 01 30 00 - Administrative Requirements: Submittals procedures.

C. Section 01 40 00 - Quality Requirements: Testing and inspection procedures.

D. Section 01 50 00 - Temporary Facilities and Controls: Temporary interior partitions.

E. Section 01 51 00 - Temporary Utilities: Temporary heating, cooling, and ventilating facilities.

F. Section 01 74 19 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.

G. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds.

2.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

B. North East Collaborative for High Performance Schools Protocol (NECHPS) Version 3.1, August 2014.

2.04 NECHPS POINTS REQUIREMENTS FOR CONSTRUCTION

A. This project is governed by the Rhode Island Department of Education Construction Requirements and is therefore subject to the requirements of the North East Collaborative for High Performance Schools. As such, the following elective credit points and pre-requisites must be met by the construction process in order to comply with these standards. It is the responsibility of all contractors to review and verify that the materials, components, and construction methods, and documentation thereof meet the requirements set forth in the referenced NECHPS protocol.

B. Prerequisites and Elective Credit Points Relevant to the Construction Process with Documentation Requirements by the Contractor:

1. <u>II 1.0 - Integration</u>
    a. Contstruction Managers (CM) are to take part in drawing reviews and school level meetings prior to construciton to allow for commentary and integration of suggestions.
    b. The CM shall provide a letter indicating that they have participated in the meetings noted above (as applicable).
2. <u>II 9.1 - Innovation</u>
    a. Green During Construction Pledge:

1) Apply dust suppression controls, especially silica control measures, during construction. Water spray dust control measures have been shown to reduce respirable crystalline silica dust during various construction and mining operations worldwide. Equipment removes silicate particles from the air, while general purpose sprinklers reduce the settled dust on surfaces and area. Landscaping policy can minimizes destruction to standing foliage etc to reduce general dust exposures. [RI DEM has a fugitive dust rule that restricts offsite community exposure.]
2) Restrict idling of gasoline and diesel vehicles. Diesel idling is already prohibited under state law, though it is frequently ignored. No such rule exists for gasoline equipment though such equipment and vehicles are a major cause of carbon monoxide poisoning.
3) Reduce exhaust emissions Gasoline powered vehicles and equipment produce prodigious amounts of carbon monoxide (CO), a lethal gas. {Centers for Disease control report two thousand seven hundred CO poisonings from worksites each year.] Gasoline emissions have been shown to exceed one in one hundred thousand cancer risk thresholds in northeast urban areas. Prolonged exposure to diesel exhaust can exacerbate asthma and other lung and cardiovascular diseases, and probably increases the risk of lung cancer
4) See: https://www.coshnetwork.org/node/223 for details

3. OM 1.0 - Facility Staff & Occupant Training
   a. Contractors shall assist the Owner in developing a training manual/user's guide for teachers and staff to understand the high performance aspects of the school, specifically for the basic HVAC and lighting systems operations. A training class must be held at the completion of the project with the resident school staff.
4. EQ 1.1 - Enhanced Filtration
   a. Provide proof of purchase and installation of MERV-13 filters where indicated on drawings.
5. EQ 2.0 1-4, 2.06 Pollutant and Chemical Source Control
   a. Provide photographs of installed:
      1) Exhaust fans / exhaust returns in chemical storage rooms, janitor's closets, photocopy areas
      2) Walk off mats
      3) Hard paved areas of at least 8'x8' outside of all entrances
      4) Spark ignition gas-fired equipment (no pilot-light equipment allowed)
      5) Carbon Monoxide sensors located in all areas with gas-fired equipment
6. EQ5.1 Construction Indoor Air Quality Management
   a. Contractor to meet the recommended design approach published by SMACNA - "IAQ Guidelines for Occupied Buildings Under Construction", 2007, Chapter 3, including erosion and sediment control measures to minimize dust (where applicable).
   b. Follow SMACNA guidelines for "Duct Cleanliness for New Construction Guidlines" according to advanced levels fo cleanliness. Key items include:
      1) Seal all ductwork in transport
      2) Store ductwork in clean, dry conditions and keep sealed.
      3) Wipe down interior surfaces of ductwork immediately prior to installation.
      4) Seal open ends of installed ductwork and overnight work-in-progress.
      5) During installation, protect ductwork waiting to be installed with surface wrapping, etc.
      6) During construction, seal HVAC supply and return openings to protect them from dust.
   c. Building Flush Out
      1) Flush building at the maximum outdoor air damper posiltion for 24 hours per day for 7 consecutive days prior to occupancy.
   d. Submit photographic records with narratives explaining measures taken to comply.

e. Submit narrative of building flush out methods followed and dates/times when it occurred.

7. EQ5.1 Construction Moisture Management
   a. Mold Prevention - Building materials, especially porous materials (gypsum wallboard, wood, insulation, paper, etc.) shall be kept dry to preven grown of mold and bacteria. Cover all materials to prevel rain damage and utilize spacers to prevent moisure build-up if stored outdoors. Water damaged materials shall be dried within 24 hours. Materials that have been wet for more than 24 hours shall be discarded. Immidiately remove all items that have mold or bacterial growth from the project site.
   b. Submit photographic records with narratives explaining measures taken to comply.
8. EQ6.1 Post Construction Indoor Air Quality
   a. HEPA Vacuuming - Vacuum carpeted and soft-surfaces with a certified vacuum or high-efficiency particulate air filter (HEPA filtered) vacuum that meets or exceeds the CRI seal of approval / green label vacuum cleaner program after the construction is completed prior to occupancy. For Phased/occupied projects, soft surfaces adjacent to the construction shall be vacuumed daily during construction.
   b. Provide a signed letter from the Superintendant stating that:
      1) Carpeting in occpied areas shall be vacuumed daily.
      2) Only CRI SOA program vacuums with manufacturer model numbers listed on the CRI SOA program website list will be permitted to be used for daily vacuuming.
      3) Maintenance staff shall keep a daily written record log reviewed by the School Facilities Manager.
9. EQ7.0 Low Emitting Materials
   a. Paints, sealants and finishes: 90% of all paints, sealers, stains, finishes and coatings applied to the interior of the building must meet the CARB 2007 Suggested Control Measures (SCM) or the South Coast Air Quality Management District (SCAQMD) Rule 113 (June 3, 2011). Compliance shall be documented by prodcut data sheets or equivalent.
   b. Resiliant Floor and Carpeting: 75% or more of all resiliant flooring and carpet systems installed in the project interior shall be tested for emissions of VOCs of concern with respect to chronic inhalation exposures following the specifications of the CDPH Standard Method V1.1 2010 and shall be compliant with same when modeled to the school classroom scenario described therein.
   c. Composite Wood: Compisite wood (including core and veneer hardwood plywood (HWPW), particleboard (PB), and medium density fiberboard (MDF)) shall meet the California Air Resources Board Airborne Toxic Control Measure (ATCM) to Reduce Formealdehyde Emiisions from Componsit Wood Products, California Code Regulations, Title 17, SEctions 93120-93120.12).
   d. Adhesives and Sealants: All adheasives and sealants used (not including structural adhesives) shall meet the VOC Content Requirements in the applicable category of the South Coast Air Quality Management District (SCAQMD) Rule 1168. Further, base adhesives and sealants shall be tested for emmissions of VOCs of Concern with respect to chronic inhalation exposure following the specifications of the CDPH/EHLB Standard Method V1.1 2010, and test resulls shall be compliant with the Standard Method when modeled to the school classroom scenario using the manufacturer's specified coverages for floor area and wall areas as applicable.
   e. Submit the schedule of values for the project, formatted to group together all products within any category claimed for low-emitting credit or prerequisite. Include subtotals of the value for compliant products and and all products by category. Include chain of custody documentation and applicable product labels and data sheets.
10. EQ13.1 / 2 Electric Lighting Performance
    a. Published CRI of 85 or greater, flicker from LEDs of less than 10% across the dimming range, and an L70 rating of 50,000 hours for 13.1, or 100,000 hours for 13.2.
    b. Submit reciepts/proof of purchase for all systems along with cut sheets with required data.

c. Submit pictures of installed system in a typical classroom.

11. EQ14.1 Acoustical Performance
    a. A qualified acoustical testing agency shall be hired to perform all necessary verification of compliance with the required NECHPS acoustic performance metrics.
    b. Conduct Reverberation time requirement testing in compliance with Section !.4.2 of ANSI/ASA Standard S12.60-2010/Part 1 to randomly selected classrooms.
    c. Conduct either a Total Backgroud Noise test or Exterior Source Background Noise Test/Background Noise Test from Building Services and Utilities.
        1) Total Background Noise - Test at least 1 classroom per facade during regular school hours. Turn services on and select the loudest allowable setting. Scan room for "key" location per section A.1.2 of ANSI/ASA Standard S12.60-2010/Part 1. Perform measurement at a height of 40"-48" above the floor for 30 minutes at 5 second intervals.
        2) Exterior Source / Building Service Utility Background Noise -
            (a) Exterior - For each facade, test the classroom expected to be most affected by the maximum exterior noise (L-EQ) at the expected time of occurance with buliding systems off and adjacent classrooms and corridors empty. Measurement shall be in the center of the classroom 40"-48" above the floor for 30 minutes at 5 second intervals. Testing instrument shall conform to A.1.2 of ANSI/ASA Standard S12.60-2010/Part 1.
            (b) Interior - Conduct all testing in conformance with A.1 of ANSI/ASA Standard S12.60-2010/Part 1. In schools with central HVAC systems, classrooms closest to the central units shall be tested. Other classroms shall be randomly selected. In schools with a distributed HVAC system, classrooms shall be randomly selected. Quantity or rooms tested shall be 1/2 of the square root of the total umber of classrooms, rounded up to the nearest whole number.
    d. Conduct wall and floor assembly indoor-to-indoor attenuation tests.
        1) One of each of the partition types shlal be tested for airborne sound attenuation:
            (a) Classroom/Classroom Wall
            (b) Classroom/Public Restroom Wall
            (c) Classroom/Classroom floor/ceiling assembly
            (d) All operable partitions.
            (e) All classroom partitions that include doors.
        2) The Third-Party reviewer shall select the specific partions to be tested, and test in accordance with ASTM E336-09. NIC shall be within 3 points of the laboratory STC rating, except for operable partitions, which are required to be within 5 points of the laboratory STC rating.
    e. Conduct structure-borne impact sound isolation verification.
        1) Verification of conformance to the structure-borne impact sound isolation requirements shall be conducted according to Section A.3.2 of ANSI/ASA Standard S12.60-2010/Part 1.The verification shall be conducted in the same classroom for which the airborne floor-ceiling sound attenuation is verified.

12. EE3.0-3.3 Commisioning
    a. See detained specifications in section 01 01 13 and other reference specifciations within this document.
    b. Construction closeouts shall include the Final Commissioning Report and the Systems Manuals.
    c. For EE3.3 - Submit a report summarizing the first year optimization process.

13. EE7.0 Local Energy Efficiency Incentives and Assitance
    a. Submit documentation to confirm participation in any programs that could not be utilized prior to construction.

14. WE1.0 Minimum Reduction in Indoor Potable Water Use
    a. Provide pictures of installed fixtures along with manufacturer receipts, proof of purchase, or approved submittals for the water-efficienty products purchased.

15. WE2.1 Reduce Potable Water Use for Sewage Conveyance
    a. Provide pictures of installed fixtures along with manufacturer receipts, proof of purchase, or approved submittals for the water-efficienty products purchased.
16. SS12.1 Avoid Light Pollution and Unnecessary Ligthing
    a. Provide pictures of installed fixtures along with manufacturer receipts, proof of purchase, or approved submittals for the compliant lighting products purchased.
17. MW1.0 Storage and Collection of Recyclables
    a. Provide pictures of central recycling collection point and typical classroom/common area recycling bins/dumpsters.
18. MW2.0/2.1 Minimum Construction Site Waste Management
    a. Contractors shall successfully salvage, recycle, and divert construciton demolition material from landfills through a well thought out waste management plan and on-site training for contractors and subcontractors. Recycle reuse, and/or salvage ate least 50% (MW2.01) or 75% (MW2.1.1) (by weight) of non-hazardous construction and demolistion waste, not including land clearing and associated debris.
    b. Provide a written diversion summary and back up documentation for where debris was taken.
19. MW3.1 Recycled Content
    a. Maximize post-consumer recycled content. Provide the CHPS Materials Worksheet for products with recycled content indicated in the individual specifications. Provide cut sheets for materials claimed to have the required recycled contents as defined in the individual product specifications, along with proof of purchase for the material.
20. MW5.1 Certified Wood
    a. Maximize post-consumer recycled content. Provide the CHPS Materials Worksheet for products with certified wood content indicated in the individual specifications, along with cut sheets, proof of purchase, and chain of custody certificates signed by manurfacturers certifying that the product meets the required standard.
21. MW8.1 Building Reuse - Exterior
    a. Reuse at least 50% of a building's existing structure and shell for a single point, and 75% of a building's existing structure and shell for two (2) points.
    b. Contractor shall provide the CHPS Mateirals Worksheet, along with photos taken before and after of major or large reuse of structural or shell elements.
22. MW9.1 Building Reuse - Interior
    a. Reuse at least 50% of a building's existing non-structural elements in at least 50% of the completed building area.
    b. Contractor shall provide the CHPS Mateirals Worksheet, along with photos taken before and after of major or large reuse of non-structural or shell elements.

2.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.
   2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
   3. Submit surveys and survey logs for the project record.

C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of North Providence School Department or separate Contractor.

2.06 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After North Providence School Department occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of North Providence School Department's activities.

PART 2 PRODUCTS

3.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00.

PART 3 EXECUTION

4.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

4.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

4.03 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

F. Utilize recognized engineering survey practices.

G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
   2. Grid or axis for structures.
   3. Building foundation, column locations, ground floor elevations.

H. Periodically verify layouts by same means.

I. Maintain a complete and accurate log of control and survey work as it progresses.

4.04 GENERAL INSTALLATION REQUIREMENTS

A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.

B. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

D. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

E. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

F. Make neat transitions between different surfaces, maintaining texture and appearance.

4.05 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as shown.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.

C. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.
   2. Relocate items indicated on drawings.

D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.

3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
    a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
    b. Provide temporary connections as required to maintain existing systems in service.
4. Verify that abandoned services serve only abandoned facilities.
5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

E. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.

F. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
3. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.

G. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

H. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

I. Clean existing systems and equipment.

J. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

K. Do not begin new construction in alterations areas before demolition is complete.

L. Comply with all other applicable requirements of this section.

4.06 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. Perform whatever cutting and patching is necessary to:
1. Complete the work.
2. Fit products together to integrate with other work.
3. Provide openings for penetration of mechanical, electrical, and other services.
4. Match work that has been cut to adjacent work.
5. Repair areas adjacent to cuts to required condition.
6. Repair new work damaged by subsequent work.
7. Remove samples of installed work for testing when requested.
8. Remove and replace defective and non-conforming work.

C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

D. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

E. Restore work with new products in accordance with requirements of Contract Documents.

F. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

G. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material , to full thickness of the penetrated element.

H. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

4.07 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

E. NE CHPS - For phased, occupied renovations HEPA vacuum the carpet daily in the occupied areas.

4.08 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Prohibit traffic from landscaped areas.

H. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

4.09 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify that wiring and support components for equipment are complete and tested.

E. Execute start-up under supervision of applicable Owners Project Manager personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

4.10 DEMONSTRATION AND INSTRUCTION

A. See Section 01 79 00 - Demonstration and Training.

4.11 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

4.12 FINAL CLEANING

A. Use cleaning materials that are nonhazardous.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

E. Clean filters of operating equipment.

F. Clean debris from roofs, gutters, downspouts, and drainage systems.

G. Clean site; sweep paved areas, rake clean landscaped surfaces.

H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

4.13 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.

B. Notify Architect when work is considered ready for Substantial Completion.

C. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's review.

D. North Providence School Department will occupy all of the building as specified in Section 01 10 00.

E. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to North Providence School Department-occupied areas.

F. Notify Architect when work is considered finally complete.

G. Complete items of work determined by Architect's final inspection.

4.14 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the North Providence School Department.

END OF SECTION 01 70 00

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. North Providence School Department requires that this project generate the least amount of trash and waste possible.

B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. North Providence School Department may decide to pay for additional recycling, salvage, and/or reuse based on Landfill Alternatives Proposal specified below.

E. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury

F. Hazardous materials shall be removed and remediated in accordance with the Hazardous Material Abatement Plan. See Specification Section 00 01 02 Project Information for additional inofrmation.

G. Owners Project Manager shall submit periodic Waste Disposal Reports; all landfill disposal, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.

H. Owners Project Manager shall develop and follow a Waste Management Plan designed to implement these requirements.

I. Methods of trash/waste disposal that are not acceptable are:
   1. Burning on the project site.
   2. Burying on the project site.
   3. Other illegal dumping or burying.

J. Regulatory Requirements: Owners Project Manager is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. Section 01 50 00 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.

C. Section 01 70 00 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

1.03 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

PART 2 PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

A. See Section 01 60 00 - Product Requirements for substitution submission procedures.

B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 01 60 00:
   1. Relative amount of waste produced, compared to specified product.
   2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Sum.
   3. Proposed disposal method for waste product.
   4. Markets for recycled waste product.

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

A. See Section 01 10 00 for list of items to be salvaged from the existing building for relocation in project or for North Providence School Department.

B. See Section 01 30 00 for additional requirements for project meetings, reports, submittal procedures, and project documentation.

C. See Section 01 50 00 for additional requirements related to trash/waste collection and removal facilities and services.

D. See Section 01 60 00 for waste prevention requirements related to delivery, storage, and handling.

E. See Section 01 70 00 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

END OF SECTION 01 74 19

SECTION 01 78 00
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Section 01 70 00 - Execution and Closeout Requirements: Contract closeout procedures.

C. Individual Product Sections: Specific requirements for operation and maintenance data.

D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to the Architect with claim for final Application for Payment.

B. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by North Providence School Department, submit completed documents within ten days after acceptance.
   3. Submit 1 copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned , with Architect comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with North Providence School Department's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by North Providence School Department.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish main floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. For Each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.
   2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

C. Include color coded wiring diagrams as installed.

D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

F. Provide servicing and lubrication schedule, and list of lubricants required.

G. Include manufacturer's printed operation and maintenance instructions.

H. Include sequence of operation by controls manufacturer.

I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

J. Provide control diagrams by controls manufacturer as installed.

K. Provide Owners Project Manager's coordination drawings, with color coded piping diagrams as installed.

L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

M. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

N. Include test and balancing reports.

O. Additional Requirements: As specified in individual product specification sections.

3.05 OPERATION AND MAINTENANCE MANUALS

A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

B. Prepare data in the form of an instructional manual.

C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring; capacity expansion binders with durable plastic covers; 3 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Provide tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment.

F. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

G. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

H. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.

I. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Owners Project Manager, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.

f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.

3. Part 3: Project documents and certificates, including the following:
   a. Shop drawings and product data.
   b. Air and water balance reports.
   c. Certificates.
   d. Photocopies of warranties and bonds.

J. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

K. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect Owner and with name of responsible parties; schedule of products and systems, indexed to content of the volume.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with North Providence School Department's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Include photocopies of each in operation and maintenance manuals, indexed separately on Table of Contents.

F. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

G. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Owners Project Manager and equipment supplier; and name of responsible company principal.

H. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

I. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION 01 78 00

SECTION 01 81 13

SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.02 OBJECTIVES

A. To obtain acceptable water efficiency, energy efficiency, and Indoor Air Quality (IAQ) for the completed Project and minimize the environmental impacts of construction and operation, the Contractor during the construction phase of this project shall implement the following procedures singly or in combination:
   1. Select products that minimize consumption of non-renewable resources, consume reduced amounts of energy and minimize amounts of pollution to produce and transport, and employ recycled and/or recyclable materials. To help purchasers incorporate environmental considerations into purchasing decisions, it is the intent of this project to conform with EPA's Five Guiding Principles on environmentally preferable purchasing. The five principles are:
      a. Include environmental considerations as part of the normal purchasing process.
      b. Emphasize pollution prevention early in the purchasing process.
      c. Examine multiple environmental attributes throughout a product's or service's life cycle.
      d. Compare relevant environmental impacts when selecting products and services.
      e. Collect and base purchasing decisions on accurate and meaningful information about environmental performance.
   2. Control sources for potential IAQ pollutants by controlled selection of materials and processes used in project construction in order to attain superior IAQ.
   3. Products and processes that achieve the above objectives to the extent currently possible and practical have been selected and included in these Construction Documents. The Contractor is responsible to maintain and support these objectives in developing means and methods for performing the work of this Contract and in proposing product substitutions and/or changes to specified processes.

1.03 DESCRIPTION OF WORK

A. Work Included: General requirements and procedures for compliance with Version 2.0, 2009 of the Northeast Collaborative for High Performance Schools Rhode Island (NE-CHPS RI) Guidelines, including all prerequisites and credits needed for the Project to be NE-CHPS RI verified with all RI addendums, pre-requisitions and other requirement.
   1. Compliance with requirements needed to obtain NE-CHPS RI prerequisites and credits may be used as one criterion to evaluate substitution requests.
   2. Refer to the NE-CHPS RI Scorecard attached at the end of this Section for required credits.
   3. Contractor shall compile the necessary calculation to show that the total percentage achieved by the project meets the required percentage for recycle content ma(materials, rapidly renewable materials, locally produced materials, and certified wood. Contractor shall submit a proposed list within 30 days from signing of contract for review. Contractor shall submit monthly updates of these credits.
   4. Owner shall register project with the National CHPS organization and pay all registration and review fees.
   5. Owner shall pay CHPS the costs of interpretations, certification and other administrative fees.

B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Divisions 01 through 33 Sections for NE-CHPS requirements specific to the work of each of these Sections. Requirements may or may not include reference to NE-CHPS.

1.04 DEFINITIONS

A. Agrifiber Products: Composite panel products derived from agricultural fiber.

B. Composite Wood: A product consisting of wood fiber or other plant particles bonded together by a resin or binder.

C. NE-CHPS: Northeast Collaborative for High Performance Schools Guidelines, current version.

D. Forest-Stewardship Council (FSC) Certified Wood: Wood products bearing the FSC label come from forests that are managed in environmentally responsible, socially beneficial, and economically viable ways

E. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC- accredited certification body.

F. Post-Consumer Recycled Content: Defined as materials or finished product that has served its intended consumer use and has been discarded by the consumer for recovery after use (e.g., plastic soda bottle).

G. Post-Industrial Recycled Content: Defined as recovered industrial and manufacturing material that is recycled. Scrap raw materials that can be reused in the same manufacturing process from which they were recovered are not considered Post-Industrial Recycled Content. Fly-ash and synthetic gypsum, because they are waste products from coal burning electricity plants, are examples of Post-Industrial Recycled Content.

H. Bio-Based Materials: Bio-based materials contain a significant amount of materials from natural fibers, plant stalks and leaves, and plant extractions. Examples are bamboo products, wheat grass cabinetry and linoleum.

I. Salvaged or Reused Materials: Materials extracted from existing buildings in order to be reused in other buildings without be manufactured.

J. Locally Produced Materials: Materials manufactured within five hundred miles radius of the project site. The location of manufacture refers to the final assembly of components into the building product that is furnished and installed by tradesmen.

1.05 SUBMITTALS

A. General: Submit additional NE-CHPS RI submittals required by other Specification Sections.

B. NE-CHPS RI submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated NE-CHPS requirements.

PART 2 - PRODUCTS

2.01 RECYCLED CONTENT OF MATERIALS

A. For all building materials and products with the exception of plumbing, mechanical and electrical components and specialty items, such as elevators, contractor shall determine the percentage of Post-Consumer recycled content and/or Post-Industrial Recycled Content and fill out the Materials Submittal Cover Sheet located at the end of this section with that information.

B. For each item containing recycled content Contractor lists in the Materials Submittal Cover Sheet, Contractor shall also show the installed cost.

C. Contractor shall submit manufacturer product data, product literature or a letter on manufacturer letterhead verifying the percentage of post-consumer recycled content, post-industrial recycled content or both contained in each material listed in the Materials Submittal Cover Sheet. Contractor may also submit documentation from a third party certifier, such as Scientific

Certification Systems (SCS) certifying that a product contains designated percentages of recycled content.

D. Utilize all on-site existing paving materials that are scheduled for demolition as granulated fill, and include the cost of this material had it been purchased in the calculations for recycled content value.

E. Verification of post-consumer and post-industrial recycled content percentages are required for alt relevant materials including but not limited to:
   1. Division 03 - Concrete
   2. Division 04 - Masonry
   3. Division 05 - Metals
   4. Division 06 — Wood, Plastics and Composites
   5. Division 07 - Thermal and Moisture Protection
   6. Division 08 - Openings
   7. Division 09 - Finishes
   8. Division 10 - Specialties
   9. Division 11 - Equipment
   10. Division 12 — Furnishings
   11. Division 31 — Earthwork
   12. Division 32 — Exterior Improvements

2.02 CERTIFIED WOOD

A. For all wood-based materials, contractor shall identify the percentage of product that contains wood certified by the Forest Stewardship Council (FSC), and shall fill out the Materials Submittal Cover Sheet located at the end of this section with that information.

B. For each item containing FSC-Certified wood Contractor lists in the Materials Submittal Cover Sheet, Contractor shall also show the installed cost.

C. Provide vendor invoices for each wood product stating whether or not it has been harvested in accordance with the “FSC Principles and Criteria" for well-managed forests developed by the Forest Stewardship Council (FSC). Invoices shall include chain-of- custody (COC) certificate numbers and itemized costs for all certified products.

D. Wood-based materials include, but are not limited to, the following materials when made from wood, engineered wood products, or wood-based panel products:
   1. Rough carpentry. Miscellaneous carpentry.
   2. Heavy timber construction.
   3. Wood decking.
   4. Particle board.
   5. Plywood.
   6. Metal-plate-connected wood trusses.
   7. Structural glued-laminated timber.
   8. Finish carpentry.
   9. Architectural woodwork.
   10. Wood paneling.
   11. Wood veneer wall covering.
   12. Wood flooring.
   13. Wood lockers.
   14. Wood cabinets.
   15. Wood doors.
   16. Non-rented temporary construction,including bracing, concrete formwork, pedestrian barriers, and temporary protection.

2.03 BIO-BASED MATERIALS

A. For all bio-based materials, contractor shall identify the percentage of product that is bio-based and shall fill out the Materials Submittal Cover Sheet located at the end of this section with that information.

B. For each bio-based item contractor lists in the Materials Submittal Cover Sheet, Contractor shall also show the installed cost.

C. Contractor shall submit manufacturer product data, product literature or a letter on manufacturer letterhead verifying the percentage of bio-based content in each material listed in the Materials Submittal Cover Sheet.

2.04 LOW-EMITTING MATERIALS

A. The following products and systems, where installed inside the weatherproofing system, shall meet the testing and product protocols listed below.

1. Acceptable products in the categories listed below shall be certified in accordance with either Scientific Certification System's (SCS's) Indoor Advantage Gold program or SCS's FloorScore Program (see www.scscertified.com/products) or GreenGuard's Children and Schools program (see http://www.greenguard.org/en/quickSearch.aspx). Certified products will be listed on either web site. Acceptable products may also be listed in the CHPS High Performance Products Database located at http://www.chps.net/dev/Drupal/node/445. Alternatively, manufacturers may arrange for independent lab testing of materials to determine whether they meet the California Chronic Reference Exposure Levels (CRELs) as identified by the California Office of Environmental Health Hazard Assessment (OEHHA). See NE-CHPS Guidelines, page
   a. All paints and coatings that cover interior walls, floors and ceilings,
   b. All building insulation (excluding insulation exterior to the building's vapor barrier),
   c. Acoustical ceiling tiles and wall panels,
   d. Gypsum wallboard.
   e. Resilient flooring and associated adhesives.
2. Acceptable carpet systems and associated adhesives shall be certified in accordance with the Carpet and Rug Institute's Green Label Plus program (see http://www.carpet-rug.org/commercial-customers/green-building9-and-the-environment/green-label-plus/index.cfm). Acceptable products may also be listed in the CHPS High Performance Products Database located at http://www.chps.net/dev/Drupal/node/445. Alternatively, manufacturers may arrange for independent lab testing of materials to determine whether they meet the California Chronic Reference Exposure Levels (CRELs) as identified by the California Office of Environmental Health Hazard Assessment (OEHHA). See NE-CHPS Guidelines, page 83.

B. For each low-emitting material or product, Contractor shall fill out the Materials Submittal Cover Sheet identifying the certification program that the material or product meets.

C. For each low-emitting material or product, Contractor shall supply documentation verifying that it is certified as a low-emitting material in accordance with Scientific Certification System's FloorScore or Indoor Advantage Gold Program, or with GreenGuard's Children and Schools Program, or with the Carpet and Rug Institute's Green Label Plus Program, OR that the product is listed at www.chps.net in the CHPS Products Database, OR that the product was independently tested and has been shown to meet the Chronic Reference Exposure Levels (CRELs) for the VOCs identified by the California Office of Environmental Health Hazard Assessment (OEHHA).

D. Do not use composite wood, agrifiber products and laminating adhesives that contain added urea-formaldehyde resins.

2.05 COMPOSITE WOOD OR AGRIFIBER RESINS

A. For all composite wood, engineered wood and agrifiber products to be installed on the interior of the building (including plywood, particleboard, and medium density fiberboard), provide published product literature or letter from the manufacturer (on the manufacturer's letterhead) verifying that the products do not contain added urea formaldehyde resins.

2.06 COMPOSITE WOOD OR AGRIFIBER LAMINATING ADHESIVES

A. For all laminating adhesives used with composite wood, engineered wood and agrifiber products (e.g., adhesives used to laminate wood veneers to an engineered wood substrate),

provide published product literature or letter from the manufacturer (on the manufacturer's letterhead) verifying that that the adhesive products do not contain urea-formaldehyde.

2.07 HIGH ALBEDO ROOFING MATERIALS

A. For exposed roofing membranes, pavers, and ballast products, provide published product literature or letter from the manufacturer (on the manufacturer's letterhead) verifying the following minimum Solar Reflectance Index (SRI) values:
   1. 78 for low-sloped roofing applications (slope less than or equal to 2:12).
   2. 29 for steep-sloped roofing applications (slope greater than 2:12) SRI values shall be calculated according to ASTM E 1980. Reflectance shall be measured according to ASTM E 903, ASTM E 1918, or ASTM C 1549. Emittance shall be measured according to ASTM E 408 or ASTM C 1371. Vegetated roof surfaces, skylights, and photovoltaic panels are exempt from the SRI criteria.

2.08 LOCALLY PRODUCED MATERIALS

A. For all building materials and products with the exception of plumbing, mechanical and electrical components and specialty items, such as elevators, contractor shall determine if the product is manufactured within 500 miles radius of the project site and fill out the Materials Submittal Cover Sheet located at the end of this section with that information. Lighting fixtures are to be included in the locally produced materials calculation.

B. For each item produced in the 500 miles radius, Contractor lists in the Materials Submittal Cover Sheet, Contractor shall also show the installed cost.

C. Contractor shall submit manufacturer product data, product literature or a letter on manufacturer letterhead verifying the production location of each material listed in the Materials Submittal Cover Sheet. Contractor should also submit map showing the manufacture location is within the 500 miles radius.

D. Contractor shall submit calculation of the percentage of the locally produced material meeting 40% of the building materials for two credits of NE CHPS Materials Elective Credit 7.

PART 3 - EXECUTION

3.01 NE-CHPS SCORECARD SUMMARY

A. Comply with requirements of Scorecard Summary as developed by the Architect and attached to this Section. Note that two versions have been included, one for base bid and one including alternates.

3.02 MATERIALS SUBMITTAL COVER SHEET

A. Documentation Sheet: Provide documentation for each material required for NE-CHPS Documentation as follows:

END OF SECTION 01 81 13

SECTION 01 91 13

GENERAL COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section specifies the Owners Project Manager's responsibilities for commissioning:
   1. Verify that the work is installed in accordance with Contract Documents and the manufacturer92s recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Owners Project Manager are utilized to achieve this.
   2. Verify and document that functional performance is in accordance with Contract Documents: Functional Tests executed by Owners Project Manager and witnessed by the Commissioning Authority are utilized to achieve this.
   3. Verify that operation and maintenance manuals submitted to North Providence School Department are complete: Detailed operation and maintenance (O&M) data submittals by Owners Project Manager are utilized to achieve this.
   4. Verify that the North Providence School Department’s operating personnel are adequately trained: Formal training conducted by Owners Project Manager is utilized to achieve this.

B. The Commissioning Authority directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Authority's responsibilities.

1.02 SCOPE OF COMMISSIONING

A. The following are to be commissioned:

B. Building envelope:
   1. Air tightness.

C. Elevating and conveying systems.

D. Plumbing Systems:

E. HVAC System, including:
   1. Major and minor equipment items.
   2. Piping systems and equipment.
   3. Ductwork and accessories.
   4. Terminal units.
   5. Control system.
   6. Sound control devices.
   7. Vibration control devices.
   8. Variable frequency drives.

F. Electrical Systems:
   1. Power quality.
   2. Emergency power systems.
   3. Lighting controls other than manual switches.

G. Electronic Safety and Security:

H. Communications:

I. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

1.03 RELATED REQUIREMENTS

A. Section 01 78 00 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing equipment will NOT become the property of North Providence School Department.

B. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:
   1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.5 degree F and resolution of plus/minus 0.1 degree F.
   2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.
   3. Calibration: According to the manufacturer's recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.

C. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to North Providence School Department; such equipment, tools, and instruments are to become the property of North Providence School Department.

D. Dataloggers: Independent equipment and software for monitoring flows, currents, status, pressures, etc. of equipment.
   1. Dataloggers required to for Functional Tests will be provided by the Commissioning Authority and will not become the property of North Providence School Department.

PART 3 EXECUTION

3.01 COMMISSIONING PLAN

A. Commissioning Authority has prepared the Commissioning Plan.
   1. Attend meetings called by the Commissioning Authority for purposes of completing the commissioning plan.
   2. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.

B. Owners Project Manager is responsible for compliance with the Commissioning Plan.

C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.

D. Commissioning Schedule:
   1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 60 days after award of Contract.
   2. Re-submit anticipated startup dates monthly, but not less than 4 weeks prior to startup.
   3. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
   4. Provide sufficient notice to Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.02 STARTUP PLANS AND REPORTS

A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 8 weeks prior to startup.

B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.

C. Submit directly to the Commissioning Authority.

3.03 PREFUNCTIONAL CHECKLISTS

A. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.
   1. No sampling of identical or near-identical items is allowed.
   2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.
   3. Prefunctional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:
      a. Certification by installing contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.
      b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.
      c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."
      d. Serial number of installed unit.
      e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer’s start-up checklist items and minor testing.
      f. Sensor and actuator calibration information.

B. Owners Project Manager is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.
   1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.
   2. Checklists with incomplete items may be submitted for approval provided the Owners Project Manager attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.
   3. Individual Checklists may contain line items that are the responsibility of more than one installer; Owners Project Manager shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.
   4. If any Checklist line item is not relevant, record reasons on the form.
   5. Owners Project Manager may independently perform startup inspections and/or tests, at Owners Project Manager's option.
   6. Regardless of these reporting requirements, Owners Project Manager is responsible for correct startup and operation.
   7. Submit completed Checklists to Commissioning Authority within two days of completion.

C. Commissioning Authority is responsible for furnishing the Prefunctional Checklists to Owners Project Manager.
   1. Initial Drafts: Owners Project Manager is responsible for initial draft of Prefunctional Checklist where so indicated in Contract Documents.
   2. Provide all additional information requested by Commissioning Authority to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.
   3. Commissioning Authority may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in Contract Documents or not.
   4. When asked to review the proposed Checklists, do so in a timely manner.

D. Commissioning Authority Witnessing: Required for:
   1. Each piece of primary equipment, unless sampling of multiple similar units is allowed by the commissioning plan.
   2. A sampling of non-primary equipment, as allowed by the commissioning plan.

E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to North Providence School Department.
   1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

3.04 FUNCTIONAL TESTS

A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.

B. Owners Project Manager is responsible for execution of required Functional Tests, after completion of Prefunctional Checklist and before closeout.

C. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.

D. Owners Project Manager is responsible for correction of deficiencies and re-testing at no extra cost to North Providence School Department; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Owners Project Manager's stated intentions regarding correction.
   1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with Contract Documents or does not perform properly.
   2. When the deficiency has been corrected, the Owners Project Manager completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Owners Project Manager shall re-test.
   3. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.
   4. Owners Project Manager shall bear the cost of North Providence School Department and Commissioning Authority personnel time witnessing re-testing.
   5. Owners Project Manager shall bear the cost of North Providence School Department and Commissioning Authority personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Owners Project Manager shall bear the cost of the second and subsequent re-tests.

E. Functional Test Procedures:
   1. Some test procedures are included in Contract Documents; where Functional Test procedures are not included in Contract Documents, test procedures will be determined by the Commissioning Authority with input by and coordination with Owners Project Manager.
   2. Examples of Functional Testing:
      a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint).
      b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc.
      c. Systems are run through all the HVAC control system’s sequences of operation and components are verified to be responding as the sequence's state.
      d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Authority is Functional Testing.

F. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these tests remains the Owners Project Manager's responsibility regardless of timing.

3.05 SENSOR AND ACTUATOR CALIBRATION

A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gauges, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.

B. Calibrate using the methods described below; alternate methods may be used, if approved by Commissioning Authority and Owner beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate and final results.

C. All Sensors:
   1. Verify that sensor location is appropriate and away from potential causes of erratic operation.
   2. Verify that sensors with shielded cable are grounded only at one end.
   3. For sensor pairs that are used to determine a temperature or pressure difference, for temperature make sure they are reading within 0.2 degree F of each other, and for pressure, within tolerance equal to 2 percent of the reading, of each other.
   4. Tolerances for critical applications may be tighter.

D. Sensors Without Transmitters - Standard Application:
   1. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
   2. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
   3. If not, install offset, calibrate or replace sensor.

E. Sensors With Transmitters - Standard Application.
   1. Disconnect sensor.
   2. Connect a signal generator in place of sensor.
   3. Connect ammeter in series between transmitter and building automation system control panel.
   4. Using manufacturer’s resistance-temperature data, simulate minimum desired temperature.
   5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.
   6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.
   7. Record all values and recalibrate controller as necessary to comply with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction.
   8. Reconnect sensor.
   9. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
   10. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
   11. If not, replace sensor and repeat.
   12. For pressure sensors, perform a similar process with a suitable signal generator.

F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:
   1. Watthour, Voltage, Amperage: 1 percent of design.
   2. Pressure, Air, Water, Gas: 3 percent of design.
   3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.4 degrees F.
   4. Relative Humidity: 4 percent of design.
   5. Barometric Pressure: 0.1 inch of Hg.
   6. Flow Rate, Air: 10 percent of design.
   7. Flow Rate, Water: 4 percent of design.

8. AHU Wet Bulb and Dew Point: 2.0 degrees F.

G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.

H. Valve/Damper Stroke Setup and Check:
1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
2. Set pump/fan to normal operating mode.
3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
4. Command valve/damper to open; verify position is full open and adjust output signal as required.
5. Command valve/damper to a few intermediate positions.
6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

I. Isolation Valve or System Valve Leak Check: For valves not associated with coils.
1. With full pressure in the system, command valve closed.
2. Use an ultra-sonic flow meter to detect flow or leakage.

3.06 TEST PROCEDURES - GENERAL

A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.

C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near-identical items is explicitly permitted, perform sampling as follows:
1. Identical Units: Defined as units with same application and sequence of operation; only minor size or capacity difference.
2. Sampling is not allowed for:
a. Major equipment.
b. Life-safety-critical equipment.
c. Prefunctional Checklist execution.
3. XX = the percent of the group of identical equipment to be included in each sample; defined for specific type of equipment.
4. YY = the percent of the sample that if failed will require another sample to be tested; defined for specific type of equipment.
5. Randomly test at least XX percent of each group of identical equipment, but not less than three units. This constitutes the "first sample."
6. If YY percent of the units in the first sample fail, test another XX percent of the remaining identical units.
7. If YY percent of the units in the second sample fail, test all remaining identical units.
8. If frequent failures occur, resulting in more troubleshooting than testing, the Commissioning Authority may stop the testing and require Owners Project Manager to perform and document a checkout of the remaining units prior to continuing testing.

D. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the “observation”).

E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example apply hot air to a space sensor using a hair dryer to see the response in a VAV box.

F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.

G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.

H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.

I. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems; where monitoring of specific points is called for in Functional Test Procedures:
   1. All points that are monitored by the relevant control system shall be trended by Owners Project Manager; at the Commissioning Authority's request, Owners Project Manager shall trend up to 20 percent more points than specified at no extra charge.
   2. Other points will be monitored by the Commissioning Authority using dataloggers.
   3. At the option of the Commissioning Authority, some control system monitoring may be replaced with datalogger monitoring.
   4. Provide hard copies of monitored data in columnar format with time down left column and at least 5 columns of point values on same page.
   5. Graphical output is desirable and is required for all output if the system can produce it.
   6. Monitoring may be used to augment manual testing.

3.07 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 78 00 - Closeout Submittals for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to North Providence School Department.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to North Providence School Department.

END OF SECTION 01 91 13

SECTION 02 41 00

DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of building elements for alteration purposes.

B. Legal disposal of demolished items.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Limitations on Owners Project Manager's use of site and premises.

B. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

C. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.

D. Section 01 70 00 - Execution and Closeout Requirements: Contractor Points Requirements for the North East Collaborative for High Performance Schools (NECHPS).

E. Section 01 74 19 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.05 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.
   1. Minimum of ten years of documented experience.

1.06 PROJECT CONDITIONS

A. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

PART 3 EXECUTION

2.01 SCOPE

A. As indicated on Drawings and herein specified.

B. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as required so that required rough grade elevations do not subside within one year after completion.

2.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with other requirements specified in Section 01 70 00 Execution and Closeout Requirements.

B. Comply with applicable codes and regulations for demolition operations and safety of the public.
   1. Obtain required permits.
   2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   3. Provide, erect, and maintain temporary dust proof partitions/wall assembly barriers and security devices.

4. Use adequate physical barriers and wall assemblies to prevent access to areas that could be hazardous to workers or the public.
5. Conduct operations to minimize effects on and interference with adjacent construction and occupants.
6. Do not close or obstruct means of egress corridors, roadways or sidewalks without permit.
7. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.

C. Do not begin removal until receipt of notification to proceed from North Providence School Department.

D. Do not begin removal until built elements to be salvaged or relocated have been removed.

E. Protect existing structures and other elements that are not to be removed.
1. Prevent movement or settlement of adjacent structures.
2. Stop work immediately if adjacent structures appear to be in danger.

F. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

G. If hazardous materials are discovered during removal operations, stop work and notify Architect and North Providence School Department; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

2.03 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not close, shut off, or disrupt existing life safety systems that are in use without permission from the Owner.

D. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without permission from the Owner.

E. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary. Call "Miss Utility" at least 48 hours prior to starting work.

F. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

G. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

2.04 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
1. Verify that construction and utility arrangements are as shown.
2. Report discrepancies to Architect before disturbing existing installation.
3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Separate areas in which demolition is being conducted from other areas that are still occupied.
1. Provide, erect, and maintain temporary dustproof partitions and wall assemblies during demolition and construction.

C. Remove existing work as indicated and as required to accomplish new work.
1. At areas of demolition and transition, remove materials and finishes including, but not limited to, rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
2. Remove items indicated on drawings and notes.

D. Services (Including but not limited to HVAC, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

E. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removal neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch as specified for patching new work.
   5. Patch to match existing at areas of transition and demolition unless noted and/or scheduled otherwise.

2.05 EXISTING SITE IMPROVEMENTS DEMOLITION

A. Existing Subsurface Conditions: Verify existing pavement materials and respective thicknesses during pre-bid inspection. Obtain written authorization from the Owner before conducting test hole explorations of existing pavements within the project site. Conditions existing during prebid inspections will not be altered or modified.

B. Existing Pavements: Demolish existing pavements to limits indicated. Neatly cut existing bituminous concrete pavement to straight, smooth and sharp edges perpendicular to pavement surface.

C. Existing Walks: Demolish existing walks to the nearest joint to limits indicated on the contract documents.

D. Existing Curbing: Demolish existing curbing to the nearest joint to limits indicated on the contract documents.

E. Miscellaneous: Demolish additional miscellaneous existing site improvements indicated, specified and required to construct project.

2.06 EXISTING UNDERGROUND UTILITY DEMOLITION

A. Excavate and expose existing underground utilities and related structures designated for, or as required to implement, removals. Remove existing utility structure castings. Backfill excavations, upon completion of utility demolition operations.

2.07 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Remove from site all materials not to be reused on site; comply with requirements of Section 01 74 19 - Waste Management.

C. Leave site in clean condition, ready for subsequent work.

D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION 02 41 00

SECTION 03 10 00
CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

1.02 RELATED REQUIREMENTS

A. Section 03 20 00 - Concrete Reinforcing.

B. Section 03 30 00 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

A. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials.

B. ACI 301 - Specifications for Structural Concrete.

C. ACI 347R - Guide to Formwork for Concrete.

D. PS 1 - Structural Plywood.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 347, ACI 301, and ACI 318.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver prefabricated forms and installation instructions in manufacturer's packaging.

B. Store prefabricated forms off ground in ventilated and protected manner to prevent deterioration from moisture.

PART 2 PRODUCTS

2.01 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct to provide resultant concrete that conforms to design with respect to shape, lines, and dimensions.

C. Comply with applicable State and local codes with respect to design, fabrication, erection, and removal of formwork.

2.02 WOOD FORM MATERIALS

A. Lumber: HEM-FIR species; #2 grade; with grade stamp clearly visible.

2.03 REMOVABLE PREFABRICATED FORMS

A. Preformed Steel Forms: Minimum 16 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

2.04 FORMWORK ACCESSORIES

A. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.

B. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Align joints and make watertight. Keep form joints to a minimum.

E. Obtain approval before framing openings in structural members that are not indicated on drawings.

F. Provide fillet strips on external corners of beams, joists, and columns.

G. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.

H. Coordinate this section with other sections of work that require attachment of components to formwork.

I. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect before proceeding.

3.03 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

3.04 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set in place items that will be cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

F. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.05 FIELD QUALITY CONTROL

A. Do not reuse wood formwork more than 2 times for concrete surfaces to be exposed to view. Do not patch formwork.

3.06 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

END OF SECTION 03 10 00

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Supports and accessories for steel reinforcement.

1.02 RELATED REQUIREMENTS

A. Section 03 10 00 - Concrete Forming and Accessories.

B. Section 03 30 00 - Cast-in-Place Concrete.

C. See Structural Drawings for additional Project Specifications. If Conflicting Project Specifications arise, the Project Specifications on the Structural Drawings govern.

1.03 REFERENCE STANDARDS

A. ACI 301 - Specifications for Structural Concrete.

B. ACI SP-66 - ACI Detailing Manual.

C. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

E. CRSI (DA4) - Manual of Standard Practice.

1.04 SUBMITTALS

See Section 01 30 00 - Administrative Requirements, for submittal procedures.

A. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.
   1. Prepare shop drawings under supervision of a Professional Structural Engineer experienced in design of work of this type and licensed in Rhode Island.

B. Manufacturer's Certificate: Certify that reinforcing steel and accessories, products supplied for this project meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301.
   1. Maintain one copy of each document on project site.

B. Provide Architect with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
   1. Plain billet-steel bars.
   2. Unfinished.
   3. Galvanized in accordance with ASTM A767/A767M, Class I.
   4. Epoxy coated in accordance with ASTM A775/A775M.

B. Reinforcing Steel: ASTM A706/A706M, deformed low-alloy steel bars.
   1. Unfinished.
   2. Galvanized in accordance with ASTM A767/A767M, Class I.
   3. Epoxy coated in accordance with ASTM A775/A775M.

C. Steel Welded Wire Reinforcement: Galvanized ASTM A 185/A 185M, plain type.
   1. Flat Sheets.

2. Mesh Size and Wire Gage: As indicated on drawings.

D. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gage.
   2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
   3. Provide galvanized components for placement within 1-1/2 inches of weathering surfaces.

2.02 RE-BAR SPLICING:

A. Coupler Systems: Mechanical devices for splicing reinforcing bars; capable of developing full steel reinforcing design strength in tension and compression.

B. Dowel Bar Splicer with Dowel-Ins: Mechanical devices for connecting dowels; capable of developing full steel reinforcing design strength in tension and compression.

C. Grout: Cementitious, non-metallic, non-shrink grout for use with manufacturer's grout sleeve reinforcing bar coupler system.

2.03 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.

B. Locate reinforcing splices not indicated on drawings at point of minimum stress.
   1. Review locations of splices with Architect.

PART 3 EXECUTION

3.01 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.

B. Do not displace or damage vapor barrier.

C. Accommodate placement of formed openings.

D. Conform to applicable code for concrete cover over reinforcement.

3.02 FIELD QUALITY CONTROL

A. Inspect installed reinforcement for conformance to contract documents before concrete placement.

END OF SECTION 03 20 00

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Slabs on grade.

B. Concrete footings.

C. Joint devices associated with concrete work.

D. Concrete curing.

1.02 RELATED REQUIREMENTS

A. Section 03 10 00 - Concrete Forming and Accessories: Forms and accessories for formwork.

B. Section 03 20 00 - Concrete Reinforcing.

C. See Structural Drawings for additional Project Specifications. If Conflicting Project Specifications arise, the Project Specifications on the Structural Drawings govern.

1.03 REFERENCE STANDARDS

A. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials.

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.

C. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete.

D. ACI 301 - Specifications for Structural Concrete.

E. ACI 302.1R - Guide to Concrete Floor and Slab Construction.

F. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

G. ACI 305R - Guide to Hot Weather Concreting.

H. ACI 308R - Guide to External Curing of Concrete.

I. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.

J. ACI 347R - Guide to Formwork for Concrete.

K. ASTM C33/C33M - Standard Specification for Concrete Aggregates.

L. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

M. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.

N. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.

O. ASTM C150/C150M - Standard Specification for Portland Cement.

P. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete.

Q. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

R. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete.

S. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.

T. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

U. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

V. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.

W. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

X. ASTM C1116/C1116M - Standard Specification for Fiber-Reinforced Concrete.

Y. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

Z. ASTM D994/D994M - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).

AA. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

AB. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.

AC. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

AD. COE CRD-C 513 - COE Specifications for Rubber Waterstops.

AE. NSF 61 - Drinking Water System Components - Health Effects.

AF. NSF 372 - Drinking Water System Components - Lead Content.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

C. Mix Design: Submit proposed concrete mix design.
   1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
   2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.

D. Test Reports: Submit report for each test or series of tests specified.

E. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.

F. North East Collaborative for High Performance Schools (NECHPS) Submittal: Submit percentage, by weight, of recycled content including fly ash, ground granulated blast furnace slag, silica fume, rice hull ash, or other waste material is used in mix designs to replace Portland cement. Submit the total weight of concrete cast in place, mix design(s) used showing the quantity of portland cement replaced.

G. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

H. Warranty: Submit manufacturer warranty and ensure forms have been completed in North Providence School Department's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

B. Follow recommendations of ACI 305R when concreting during hot weather.

C. For slabs required to include moisture vapor reduction admixture (MVRA), do not proceed with placement unless manufacturer's representative is present for every day of placement.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Slabs with Moisture Vapor Reducing Admixture (MVRA): Provide warranty to cover the cost of flooring failures due to moisture migration from slabs for life of the concrete.

1. Include cost of repair or removal of failed flooring, placement of topical moisture remediation system, and replacement of flooring with comparable flooring system.
2. Provide warranty by manufacturer of MVRA matching terms of flooring adhesive or primer manufacturer's material defect warranty.

C. Moisture Emission Reducing Curing and Sealing Compound: Provide warranty to cost of flooring delamination failures for 10 years.
1. Include cost of repair or removal of failed flooring, remediation with a moisture vapor impermeable surface coating, and replacement of flooring with comparable flooring system.

PART 2 PRODUCTS

2.01 FORMWORK

A. Comply with requirements of Section 03 10 00.

2.02 REINFORCEMENT

A. Comply with requirements of Section 03 20 00.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I - Normal Portland type.
1. Acquire all cement for entire project from same source.

B. Fine and Coarse Aggregates: ASTM C 33.
1. Acquire all aggregates for entire project from same source.

C. Lightweight Aggregate: ASTM C330/C330M.

D. Fly Ash: ASTM C618, Class C or F.

E. Water: Clean and not detrimental to concrete.

2.04 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Air Entrainment Admixture: ASTM C260/C260M.

C. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.

D. Moisture Vapor Reduction Admixture (MVRA): Liquid, inorganic admixture free of volatile organic compounds (VOCs) and formulated to close capillary systems formed during curing to reduce moisture vapor emission and transmission, with no adverse effect on concrete properties.
1. Provide admixture in all slabs to receive adhesively applied flooring .
2. Products:
a. Barrier One, Inc; Barrier One Moisture Vapor Reduction Admixture: www.barrierone.com/#sle.
b. Substitutions: See Section 01 60 00 - Product Requirements.

E. Waterproofing Admixture: Admixture formulated to reduce permeability to liquid water, with no adverse effect on concrete properties.
1. Admixture Composition: Crystalline, functioning by growth of crystals in capillary pores.
2. Potable Water Contact Approval: NSF certification for use on structures holding potable water, based on testing in accordance with NSF 61 and NSF 372.
3. Products:
a. PENETRON International, Ltd, distributed by GCP Applied Technologies; PENETRON Admix: www.penetron.com; www.gcpat.com/#sle.
b. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 ACCESSORY MATERIALS

A. Underslab Vapor Retarder: Multi-layer, fabric-, cord-, grid-, or aluminum-reinforced polyethylene or equivalent, complying with ASTM E1745, Class A; stated by manufacturer as

suitable for installation in contact with soil or granular fill under concrete slabs. The use of single ply polyethylene is prohibited.

1. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations in vapor retarder.
2. Products:
    a. ISI Building Products; Viper VaporCheck II 15-mil (Class A): www.isibp.com/#sle.
    b. W. R. Meadows, Inc; PERMINATOR Class A - 15 mils (0.38 mm): www.wrmeadows.com/#sle.
    c. Stego Industries, LLC; Stego Wrap Vapor Barrier 15-mil (Class A): www.stegoindustries.com.
    d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

1. ASTM C1107/C1107M; Grade A, B, or C.
2. Flowable Products:
    a. Dayton Superior Corporation; Sure-Grip High Performance Grout: www.daytonsuperior.com/#sle.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 BONDING AND JOINTING PRODUCTS

A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.

1. Products:
    a. Kaufman Products Inc.; SureBond: www.kaufmanproducts.net/#sle.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Epoxy Bonding System:

C. Waterproofing Admixture Slurry: Slurry coat of Portland cement, sand, and crystalline waterproofing additive, mixed with water in proportions recommended by manufacturer to achieve waterproofing at cold joints in concrete.

D. Waterstops: Rubber, complying with COE CRD-C 513.

E. Reglets: Formed steel sheet, galvanized, with temporary filler to prevent concrete intrusion during placement.

F. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.

1. Material: ASTM D1751, cellulose fiber.

G. Slab Contraction Joint Device: Preformed linear strip intended for pressing into wet concrete to provide straight route for shrinkage cracking.

H. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with minimum 1 inch diameter holes for conduit or rebars to pass through at 6 inches on center; ribbed steel stakes for setting.

2.07 CURING MATERIALS

A. Evaporation Reducer: Liquid thin-film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.

B. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.

C. Curing and Anti-Spalling Compound: Boiled linseed oil compound.

1. Application: Use on roadway, bridge deck, parking deck, and ramps.
2. Products:
    a. Dayton Superior Corporation; Anti Spall J33: www.daytonsuperior.com/#sle.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

D. Resin Curing Compound: Solvent-based liquid, white pigmented, membrane-forming.
   1. For use on exterior slabs. When slab will be painted, sealed, topped, or receive other applied finish, completely remove curing compound after curing is complete and before finish coatings are applied.
   2. Products:
      a. Dayton Superior Corporation; White Resin Cure J10W: www.daytonsuperior.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

E. Curing and Sealing Compound, Moisture Emission Reducing: Liquid, membrane-forming, clear sealer, for application to newly placed concrete; capable of providing adequate bond for flooring adhesives, initially and over the long term; with sufficient moisture vapor impermeability to prevent deterioration of flooring adhesives due to moisture emission.
   1. Use this product to cure and seal all slabs to receive adhesively applied flooring or roofing.
   2. Comply with ASTM C309 and ASTM C1315 Type I Class A.
   3. VOC Content: Less than 100 g/L.
   4. Solids Content: 25 percent, minimum.
   5. Products:
      a. Floor Seal Technology, Inc; VaporSeal 309 System: www.floorseal.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

F. Curing and Sealing Compound: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C309.
   1. Products:
      a. BRICKFORM; BRICKFORM Gem Cure and Seal 309 - 100 VOC: www.brickform.com/#sle.

2.08 CONCRETE MIX DESIGN

A. Proportioning Structural Lightweight Concrete: Comply with ACI 211.2 recommendations.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
   1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

D. Normal Weight Concrete:
   1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: As indicated on drawings.

2.09 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

A. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
   1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
   2. Use latex bonding agent only for non-load-bearing applications.

B. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing manufacturer's instructions. Saturate cold joint surface with clean water, and remove excess water before application of coat

of waterproofing admixture slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.

C. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

D. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.
   1. Vapor Retarder Over Granular Fill: Install compactible granular fill before placing vapor retarder as shown on the drawings. Do not use sand.

3.03 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Place concrete for floor slabs in accordance with ACI 302.1R.

C. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

D. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

E. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.04 SLAB JOINTING

A. Locate joints as indicated on drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
   1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.

D. Load Transfer Construction and Contraction Joints: Install load transfer devices as indicated; saw cut joint at surface as indicated for contraction joints.

E. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.

F. Contraction Joint Devices: Use preformed joint device, with top set flush with top of slab.

G. Construction Joints: Where not otherwise indicated, use metal combination screed and key form, with removable top section for joint sealant.

3.05 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. Maximum Variation of Surface Flatness:
   1. Exposed Concrete Floors: 1/4 inch in 10 ft.
   2. Under Seamless Resilient Flooring: 1/4 inch in 10 ft.
   3. Under Carpeting: 1/4 inch in 10 ft.

B. Correct the slab surface if tolerances are less than specified.

C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.06 CONCRETE FINISHING

A. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
   1. Other Surfaces to Be Left Exposed: "Steel trowel" as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

3.07 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Surfaces Not in Contact with Forms:
   1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
   2. Final Curing: Begin after initial curing but before surface is dry.

3.08 FIELD QUALITY CONTROL

A. Provide free access to concrete operations at project site and cooperate with appointed firm.

B. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

C. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.

D. Compressive Strength Tests: ASTM C39/C39M. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd or less of each class of concrete placed.

E. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

F. Slab Testing: Cooperate with manufacturer of specified moisture vapor reduction admixture (MVRA) to allow access for sampling and testing concrete for compliance with warranty requirements.

3.09 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and Owners Project Manager within 24 hours of test.

B. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Owners Project Manager when defective concrete is identified.

D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.10 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION 03 30 00

SECTION 04 05 11

MORTAR AND MASONRY GROUT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Mortar for masonry.

1.02 RELATED REQUIREMENTS

A. Section 01 70 00 - Execution and Closeout Requirements: Contractor Points Requirements for the North East Collaborative for High Performance Schools (NECHPS).

B. Section 04 20 00 - Unit Masonry: Installation of mortar and grout.

C. See Structural Drawings for additional Project Specifications. If Conflicting Project Specifications arise, the Project Specifications on the Structural Drawings govern.

1.03 REFERENCE STANDARDS

A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.

B. ASTM C91/C91M - Standard Specification for Masonry Cement.

C. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.

D. ASTM C270 - Standard Specification for Mortar for Unit Masonry.

E. ASTM C387/C387M - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar.

F. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used. Also include required environmental conditions and admixture limitations.

C. Samples: Submit two samples of mortar, illustrating mortar color and color range.

1.05 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of the contract documents.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.07 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 MORTAR AND GROUT APPLICATIONS

A. Mortar Mix Designs: ASTM C270, Property Specification.
   1. Exterior Masonry Veneer: Type N.

2.02 MATERIALS

A. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C387/C387M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
   1. Type: Type N.
   2. Color: Mineral pigments added as required to produce approved color sample.

B. Mortar Aggregate: ASTM C144.

C. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
   1. Color(s): As selected by Architect from manufacturer's full range.

D. Water: Clean and potable.

2.03 MORTAR MIXING

A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.

B. Maintain sand uniformly damp immediately before the mixing process.

C. Do not use anti-freeze compounds to lower the freezing point of mortar.

D. If water is lost by evaporation, re-temper only within two hours of mixing.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install mortar to requirements of section(s) in which masonry is specified.

3.02 GROUTING

A. Use either high-lift or low-lift grouting techniques, at Owners Project Manager's option, subject to other limitations of contract documents.

B. Low-Lift Grouting:
   1. Limit height of pours to 12 inches.
   2. Limit height of masonry to 16 inches above each pour.
   3. Pour grout only after vertical reinforcing is in place; place horizontal reinforcing as grout is poured. Prevent displacement of bars as grout is poured.
   4. Place grout for each pour continuously and consolidate immediately; do not interrupt pours for more than 1-1/2 hours.

C. High-Lift Grouting:
   1. Verify that horizontal and vertical reinforcement is in proper position and adequately secured before beginning pours.
   2. Place grout for spanning elements in single, continuous pour.

END OF SECTION 04 05 11

SECTION 04 20 00

UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block.

B. Jumbo Brick.

C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 70 00 - Execution and Closeout Requirements: Contractor Points Requirements for the North East Collaborative for High Performance Schools (NECHPS).

B. Section 03 20 00 - Concrete Reinforcing: Reinforcing steel for grouted masonry.

C. Section 04 05 11 - Mortar and Masonry Grout.

D. Section 07 90 05 - Joint Sealers: Backing rod and sealant at control and expansion joints.

E. See Structural Drawings for additional Project Specifications. If Conflicting Project Specifications arise, the Project Specifications on the Structural Drawings govern.

1.03 REFERENCE STANDARDS

A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.

B. ACI 530.1/ASCE 6/TMS 602 - Specification For Masonry Structures; American Concrete Institute International.

C. ASTM A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

E. ASTM A580/A580M - Standard Specification for Stainless Steel Wire.

F. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

G. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

I. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

J. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement.

K. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

L. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction.

M. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale).

N. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.

O. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.

P. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units.

Q. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.

R. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale).

S. ASTM C270 - Standard Specification for Mortar for Unit Masonry.

T. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.

U. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing.

V. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.

W. IMIAWC (CW) - Recommended Practices & Guide Specifications for Cold Weather Masonry Construction; International Masonry Industry All-Weather Council; 1993.

X. IMIAWC (HW) - Recommended Practices & Guide Specifications for Hot Weather Masonry Construction; International Masonry Industry All-Weather Council; current edition.

Y. UL (FRD) - Fire Resistance Directory.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for masonry units, mortar, and masonry accessories.

C. Samples: Submit four samples of brick units to illustrate color, texture, and extremes of color range.

D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of the contract documents.
   1. Maintain one copy of each document on project site.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum ten years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least ten years of documented experience.

1.06 MOCK-UP

A. Construct a mock-up panel of size, detail and configuration indicated on the drawings. Mock-up shall include all components of the exterior wall construction.

B. Locate where directed.

C. The approved mock-up panel shall serve as the standard of quality for construction and shall remain in place until the building shell is complete and until directed to be removed by the Architect.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

1.09 EXTRA MATERIALS

A. See Section 01 60 00 - Product Requirements, for additional provisions.

B. Provide 50 of each size, color, and type of brick units for North Providence School Department use in maintenance of project.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:

1. Size: Standard units with nominal face dimensions of 16 x 8 inches and nominal depths as indicated on the drawings for specific locations.
2. Load-Bearing Units: ASTM C90, normal weight.
    a. Both hollow and solid block, as indicated.
        1) Supply grade N for all C.M.U construction.
    b. Exposed faces: Manufacturer's standard color and texture.

2.02 BRICK UNITS

A. Basis of Design:
1. Type A: Watsontown Brick - Chelsea Type 8, Smooth with iron spots.
    a. Size: 4" x 4" x 12".
    b. Substitutions: See section 01 60 00 - Product Requirements.
        1) Proposed substitutions must be submitted and approved prior to bid.
        2) If a substitution is approved, the bid form will be modified to include a bid alternate to quantify the cost savings to the Owner.

B. Facing Brick: ASTM C216, Type FBX, Grade SW.
1. Type, color and texture: Match exisitng brick.
2. Nominal size: As indicated above.
3. Bonding: 1/3 bond, to match existing.
4. Provide special shapes for applications requireing brick of size, corm, color, and texture on exposed surfaces that canot be producaed by sawing.
5. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surefaces, provide units without cores or frogs and with exposed surfaces finished.
6. Provide factory formed lip bricks fabricated from solid brick units. Refer to drawings for profiles required.
7. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.

2.03 MORTAR AND GROUT MATERIALS

A. Mortar and grout: As specified in Section 04 05 11.

2.04 REINFORCEMENT AND ANCHORAGE

A. Manufacturers of Joint Reinforcement and Anchors:
1. Blok-Lok Limited: www.blok-lok.com/#sle.
2. Dur-O-Wal: www.dur-o-wal.com.
3. Hohmann & Barnard, Inc: www.h-b.com.
4. WIRE-BOND: www.wirebond.com/#sle.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

C. Single Wythe Joint Reinforcement: ASTM A951/A951M.
1. Type: Truss or ladder.
2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3.
3. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.

D. Adjustable Multiple Wythe Joint Reinforcement: ASTM A951/A951M.
1. Type: Truss, with adjustable ties or tabs spaced at 16 in on center.
2. Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M, Class B.
3. Size: 0.1875 inch side rods with 0.1483 inch cross rods and adjustable components of 0.1875 inchwire, width of components as required to provide not less than 5/8 inch of mortar coverage from each masonry face.

4. Vertical adjustment: Not more than 1 1/4 inches.

E. Strap Anchors: Bent steel shapes configured as required for specific situations, 2 in width, 0.1875 in thick, lengths as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face, corrugated for embedment in masonry joint, hot dip galvanized to ASTM A 153/A 153M, Class B-2 or stainless steel.
   1. Strap anchors may only be used where

F. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B-2; stainless steel.
   1. Anchor channel: Not less than 0.120 inch thick, designed for fastening to structural backup by non corrodeable fasteners;.
   2. Wire ties: Triangular; Trapezoidal; Rectangular or Manufacturer's standard shape, 0.1875 inch thick.
   3. Vertical adjustment: Not less than 3-1/2 inches.
   4. Size: Coordinate to bridge insulation and air space.
   5. Basis of Design: Hohman and Barnard, HB-213,

2.05 FLASHINGS

A. Metal Flashing Materials:
   1. Stainless Steel Flashing: ASTM A666, Type 304, soft temper; 26 gauge, 0.0187 inch thick; finish 2B to 2D.
   2. Prefabricated Metal Flashing: Smooth fabricated 26 ga, 0.0747 inch stainless steel (type 304) flashing for surface-mounted and through-wall conditions.
      a. Manufacturers:
         1) Hohmann & Barnard, Inc: www.h-b.com/#sle.
         2) Substitutions: See Section 01 60 00 - Product Requirements.
   3. Provide continuous flashing, including preformed outside corners, inside corners and end dams with smooth, uninterupted, taped and sealed seams and emmed edgest to maintain continuity. Provide custom sizes as required by application.
   4. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products of products recommended by flashing manufacturer for ponding flashing sheets to each other and to submstrates. Verify compotibility between flashing materials and substrates.

B. Drip Edge: 316, 26 gage, Stainless steel; angled drip with hemmed edge; compatible with membrane and adhesives.
   1. Manufacturers:
      a. Hohmann & Barnard, Inc; DP: www.h-b.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

2.06 ACCESSORIES

A. Preformed Control Joints: Rubber or neoprene material.
   1. Manufacturers:
      a. Dur-O-Wal: www.dur-o-wal.com.
      b. Hohmann & Barnard, Inc (including Dur-O-Wal brand); Product RS or VS: www.h-b.com/#sle.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

B. Joint Filler: Closed cell polyethylene; polyurethane or rubber oversized 50 percent to joint width; self expanding; 1 inch wide design width x by maximum lengths available.
   1. Manufacturers:
      a. Dur-O-Wal: www.dur-o-wal.com.
      b. Hohmann & Barnard, Inc (including Dur -O-Wal brand): www.h-b.com/#sle.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

C. Reglets: As specified on Section 07 62 00.

D. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
   1. Mortar Diverter: Panels designed for installation at flashing locations.
      a. Manufacturers:
         1) Advanced Building Products, Inc; Mortar Break DT: www.advancedbuildingproducts.com/#sle.
         2) Sandell Mfg.: Product Mor. Product: Mortar Web = Design Basis.
         3) Mortar Net Solutions; MortarNet: www.mortarnet.com/#sle.
         4) Substitutions: See Section 01 60 00 - Product Requirements.

E. Weeps:
   1. Type: Extruded propylene with honeycomb design.
   2. Color(s): As selected by Architect from manufacturer's full range.
      a. Manufacturers:
         1) Hohmann & Barnard, Inc; Quadro-Vent: www.h-b.com/#sle.
         2) Substitutions: See Section 01 60 00 - Product Requirements.

F. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.07 GRAFFITI CONTROL

A. Graffiti Control: Clear, water-based silicone emulsion for weatherproofing and graffiti protection on all exterior masonry walls.
   1. Manufacturers:
      a. Prosoco: Sure Klean Weather Seal Blok-Guard & Graffiti Control II.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.08 LINTELS

A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam concrete masonry units with reinforcing bars placed as required and filled with coarse grout.

2.09 MORTAR AND GROUT MIXES

A. Mortar and Grout mixes as specified in Section 04 05 11.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of items supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
   1. Bond: Running.

2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Foundation Mortar Joints: Flush struck or to match existing unless noted otherwise below.

D. Brick Units:
1. Bond: 1/3 bond, to match existing.
2. Vertical Coursing: Two units and two mortar joints to equal 8 inches.
3. Mortar Joints: Concave.

3.05 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

C. Remove excess mortar and mortar smears as work progresses.

D. Interlock intersections and external corners.

E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

F. Set reglets as shown on plans.

G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

H. Cut mortar joints flush where wall tile is scheduled, cement parging is required, or resilient base is scheduled. Block exposed cavity space with raiseable steel guard of correct width.

I. Isolate masonry partitions from vertical structural framing members with a control joint .

J. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.06 WEEPS

A. Install weeps in veneer walls at 24 inches on center horizontally above opening, above through-wall flashing and at bottom of walls.

B. Install cavity vents in veneer and cavity walls at 36 inches on center horizontally near top of walls.

3.07 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.08 REINFORCEMENT AND ANCHORAGE - GENERAL

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch mortar cover on each side.

E. Lap joint reinforcement ends minimum 8 inches.

F. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 16 inches horizontally and 16 inches vertically.

G. Embed ties and anchors in mortar joint and extend into masonry unit a minimum of 1-1/2 inches with at least 5/8 inch mortar cover to the outside face of the anchor.

3.09 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Masontry Back-up: Embed truss-type joint reinforcement with adjustible ties at maximum 16 inches on center vertically. Place additional anchors at berimeter of openings and end of panels, so maximum spacing is 8 inches on center.

B. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 16 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

3.10 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 8 inches into adjacent masonry and turn up at least 2 inches to form watertight pan at non-masonry construction.
   2. Remove or cover protrusions or sharp edges that could puncture flashings.
   3. Seal lapped ends and penetrations of flashing before covering with mortar.

B. At stud back-up, terminate flashing up 8 inches minimum on vertical surface of backing:
   1. Install vertical leg of flashing over fluid-applied or self-adhered air/vapor barriers per manufacturer's directions. Affix top edge with termination bar. Intsll joint sealer at top edge of termination bar to prevent moisture mitigation under flashing.

C. At masonry back-up, terminate flashing up 8 inches minimum on vertical surface of backing, and 1-1/2 inches into the inner wythe. Form 1/4 inch hook in edge of flashing embedded in inner wythe.

D. Extend metal flashings through exterior face of masonry and turn down to form drip with hemmed edge. Install joint sealer below drip edge to prevent moisture migration under flashing.

E. Install flashing in accordance with manufacturer's instructions and BIA Technical Notes No. 7.

F. Extend metal flashings through exterior face of masonry and turn down to form drip. Install joint sealer below drip edge to prevent moisture migration under flashing.

G. Extend laminated flashings to within 1/2 inch of exterior face of masonry and adhere to top of stainless steel angled drip with hemmed edge.

H. Lap end joints of flashings at least 4 inches and seal watertight with mastic or elastic sealant, type as recommended by flashing manufacturer.

3.11 LINTELS

A. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
   1. Openings to 42 inches: Place two, No. 3 reinforcing bars 1 inch from bottom web.
   2. Openings from 42 inches to 78 inches: Place two, No. 5 reinforcing bars 1 inch from bottom web.
   3. Do not splice reinforcing bars.
   4. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
   5. Place and consolidate grout fill without displacing reinforcing.
   6. Allow masonry lintels to attain specified strength before removing temporary supports.

B. Maintain minimum 8 inch bearing on each side of opening.

3.12 GROUTED COMPONENTS

A. Reinforce bond beams as shown on plans.

B. Lap splices minimum 40 bar diameters.

C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

D. Place and consolidate grout fill without displacing reinforcing.

E. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.

3.13 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control and expansion joints.

B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.

C. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

D. Size control joints as indicated on drawings; if not indicated, 3/8 inch wide and deep.

E. Locate per drawings; if not indicated, provide every 20' horizontally.

3.14 BUILT-IN WORK

A. As work progresses, install built-in metal door frames, glazed frames, fabricated metal frames, window frames, anchor bolts, plates, and boxes and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
   1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

D. Do not build into masonry construction organic materials that are subject to deterioration.

3.15 TOLERANCES

A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft.

C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 20ft.

E. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.

F. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.16 CUTTING AND FITTING

A. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.17 FIELD QUALITY CONTROL

A. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140 for conformance to requirements of this specification.

B. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

3.18 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.19 GRAFFITI CONTROL

A. After cleaning, prepare wall for application of graffiti control product and apply per manufacturer's instructions.

3.20 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION 04 20 00

SECTION 04 43 13

STONE MASONRY VENEER

PART 1 GENERAL

PART 2 PRODUCTS

2.01 STONE

A. Granite: _____ variety; complying with ASTM C615/C615M.
   1. Grade: _____.
   2. Color: _____.
   3. Surface Finish: Polished; as described in ASTM C119 and ASTM C1528/C1528M

2.02 MORTAR APPLICATIONS

A. At Owners Project Manager's option, mortar may be field-mixed from packaged dry materials, made from factory premixed dry materials with addition of water only, or ready-mixed.

B. Mortar Color: Natural gray unless otherwise indicated.

C. Dash Bond Coat: One part Portland cement, with maximum two parts sand.

D. Scratch Coat Mortars: Scratch coat mortars for application directly to metal lath.
   1. Site-Mixed: ASTM C270, Type N or Type S, using the Proportion Method as specified in Section 04 05 11.
   2. Prepackaged/Preblended: ASTM C1714/C1714M, Type N or Type S.

E. Setting Bed Mortars: Setting bed used to adhere stone veneer units to scratch coat mortar or to bondable concrete or concrete masonry.
   1. Site-Mixed: ASTM C270, Type S, using the Proportion Method as specified in Section 04 05 11.
   2. Prepackaged/Preblended: ASTM C1714/C1714M, Type S.
   3. Prepackaged/Preblended Latex Modified: ANSI A118.4 or ANSI A118.15.

F. Setting Bed Mortars: Setting bed used to adhere stone veneer units to cement board.
   1. Prepackaged/Preblended Latex Modified: ANSI A118.4 or ANSI A118.15.

G. Pointing Mortars: Pointing or grouting mortars used to fill the joints between individual stone veneer units once the setting bed mortar has sufficiently cured.
   1. Site-Mixed: ASTM C270, Type N or Type S, using the Proportion Method as specified in Section 04 05 11.
   2. Prepackaged/Preblended: ASTM C1714/C1714M, Type N or Type S.
   3. Prepackaged/Preblended Latex Modified: ANSI A118.4 or ANSI A118.15.
   4. Color: Mineral oxide pigment; _____ color. Provide _____ manufactured by _____.

2.03 MORTAR MIXES

A. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
   1. Color: Standard gray.

B. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
   1. Application(s): Use this type of bond coat where indicated.

C. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.
   1. Applications: Use this type of bond coat where indicated.

D. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

E. Mixing: Use mechanical batch mixer and comply with referenced standards.

2.04 ACCESSORIES - ANCHORED VENEER

2.05 ACCESSORIES - ADHERED VENEER

A. Lath: See Section 09 22 36.

B. Casing Beads, Weep Screeds, and Joint Accessories: See Section 09 22 36.

C. Water-Resistive Barrier: ASTM D226/D226M or ASTM E2556/E2556M.

D. Waterproofing and Crack Isolation Membrane at Exterior Installations: Provides topside protection from water intrusion; Specifically designed for bonding to concrete, masonry, cement board, or cementitious scratch coat substrates under stone veneer setting mortar; complies with ANSI A118.10 and ANSI A118.12.

E. Flashings: See Section 04 20 00.

F. Bonding Compound: Provide type recommended for bonding scratch coat to solid surfaces, complying with ASTM C932.

G. Rainscreen Drainage Material:
   1. Rainscreen Drainage Mat: Polyester or polypropylene mesh.
      a. Thickness: 1/8 inch.
      b. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less (Class A), when tested in accordance with ASTM E84.
      c. Seam Tape and Bug Screen: As recommended by rainscreen manufacturer.
   2. Rainscreen Drainage Panels: Ribbed, dimpled, or channeled polyethylene or extruded polystyrene sheets with polypropylene fabric mortar screen on one face.
      a. Thickness: 1/8 inch.
      b. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less (Class A), when tested in accordance with ASTM E84.
      c. Seam Tape and Bug Screen: As recommended by manufacturer.
   3. Drainable Housewrap: Combination drainage layer/water-resistive sheet.
      a. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less (Class A), when tested in accordance with ASTM E84.
      b. Seam and Perimeter Tape: As recommended by housewrap manufacturer.

2.06 STONE FABRICATION - ANCHORED VENEER

PART 3 EXECUTION

3.01 PREPARATION - ANCHORED VENEER

A. Establish lines, levels, and coursing. Protect from disturbance.

3.02 INSTALLATION - ANCHORED VENEER

A. Install flashings of longest practical length and seal watertight to back-up. Lap end joints minimum 6 inches and seal watertight.

B. Size stone units to fit opening dimensions and perimeter conditions.

C. Arrange stone coursing in running bond with consistent joint width.

D. Set stone in full mortar setting bed to fully support stone over bearing surface. Use setting buttons or shims to maintain correct joint width.

3.03 REINFORCEMENT AND ANCHORAGE - ANCHORED VENEER

END OF SECTION 04 43 13

SECTION 04 72 00

CAST STONE MASONRY

PART 1 GENERAL

PART 2 PRODUCTS

2.01 ARCHITECTURAL CAST STONE

A. Cast Stone: Architectural concrete product manufactured to simulate appearance of natural granite, complying with ASTM C1364.
   1. Compressive Strength: As specified in ASTM C1364; calculate strength of pieces to be field cut at 80 percent of uncut piece.
   2. Freeze-Thaw Resistance: Demonstrated by laboratory testing in accordance with ASTM C1364.
   3. Surface Texture: Fine grained texture, with no bugholes, air voids, or other surface blemishes visible from distance of 20 feet.
   4. Remove cement film from exposed surfaces before packaging for shipment.

B. Shapes: Provide shapes indicated on drawings.
   1. Variation from Any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch or length divided by 360, whichever is greater, but not more than 1/4 inch.
   2. Unless otherwise indicated on drawings, provide:
      a. Wash or slope of 1:12 on exterior horizontal surfaces.
      b. Drips on projecting components, wherever possible.
      c. Raised fillets at back of sills and at ends to be built in.

C. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI 318.

2.02 ARCHITECTURAL SYNTHETIC STONE UNITS

A. Architectural Synthetic Stone Units: Factory-fabricated, high-density cementitious units made from cement, crushed stone, sand, and polymer reinforced with fiberglass strands; designed to simulate appearance of natural stone.
   1. Freeze-Thaw Resistance: Demonstrated by laboratory testing in accordance with ICC-ES AC219.
   2. Surface Texture: Fine grained texture, with no bugholes, air voids, or other surface blemishes visible from distance of 20 feet.
   3. Remove cement film from exposed surfaces before packaging for shipment.

B. Shapes: Provide shapes indicated on drawings.
   1. Variation from Any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch or length divided by 360, whichever is greater, but not more than 1/4 inch.
   2. Unless otherwise indicated on drawings, provide:
      a. Wash or slope of 1:12 on exterior horizontal surfaces.
      b. Drips on projecting components, wherever possible.
      c. Raised fillets at back of sills and at ends to be built in.

C. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI 318.

2.03 MATERIALS

A. Portland Cement: ASTM C150/C150M.
   1. For Mortar: Type I or II, except Type III may be used in cold weather.

B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.

C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.

D. Admixtures: ASTM C494/C494M.

E. Water: Potable.

F. Reinforcing Bars: ASTM A615/A615M, Grade 40 (40,000 psi), deformed bars, galvanized.
   1. Galvanized in accordance with ASTM A767/A767M, Class I.

G. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, epoxy coated.

H. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.

I. Shelf Angles and Similar Structural Items: Hot-dip galvanized steel per ASTM A123/A123M, of shapes and sizes as required for conditions.

J. Mortar: Portland cement-lime, as specified in Section 04 05 11; do not use masonry cement.

K. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install cast stone components in conjunction with masonry, complying with requirements of Section 04 20 00.

B. Mechanically anchor cast stone units indicated; set remainder in mortar.

C. Setting:
   1. Drench cast stone components with clear, running water immediately before installation.
   2. Set units in a full bed of mortar unless otherwise indicated.
   3. Fill vertical joints with mortar.
   4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

END OF SECTION 04 72 00

SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural steel framing members.

B. Base plates, shear stud connectors and expansion joint plates.

C. Grouting under base plates.

1.02 RELATED REQUIREMENTS

A. Section 05 21 00 - Steel Joist Framing.

B. Section 05 31 00 - Steel Decking: Support framing for small openings in deck.

C. Section 05 50 00 - Metal Fabrications: Steel fabrications affecting structural steel work.

D. See Structural Drawings for additional Project Specifications. If Conflicting Project Specifications arise, the Project Specifications on the Structural Drawings govern.

1.03 REFERENCE STANDARDS

A. AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

B. AISC (MAN) - Steel Construction Manual.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

F. ASTM A992/A992M - Standard Specification for Structural Steel Shapes.

G. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

H. AWS D1.1/D1.1M - Structural Welding Code - Steel.

I. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Section 01 70 00 - Execution and Closeout Requirements: Contractor Points Requirements for the North East Collaborative for High Performance Schools (NECHPS).

C. Shop Drawings:
   1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
   2. Connections not detailed.
   3. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

D. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.

E. Mill certification for pre-consumer and post-consumer recycled content percentage; request at time of order. Include total weight of material provided.

1.05 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."

B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.

C. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.

D. Erector: Company specializing in performing the work of this section with minimum ten years of documented experience.

E. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Rhode Island.

F. See Structural Drawings for additional Project Specifications. If Conflicting Project Specifications arise, the Project Specifications on the Structural Drawings govern.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel Angles, Plates, and Bars: ASTM A36/A36M.

B. Steel W Shapes and Tees: ASTM A992/A992M.

C. Rolled Steel Structural Shapes: ASTM A992/A992M.

D. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B.

E. Pipe: ASTM A53/A53M, Grade B, Finish Type E or S.

F. High Strength Bolts: ASTM A325N.

G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

H. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
   1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.
   2. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.

I. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

J. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Shop fabricate to greatest extent possible.

2.03 FINISH

A. Shop prime structural steel members. Do not prime surfaces that will be fireproofed.

B. All steel exposed to weather shall be painted with rust inhibitive primer and hot dipped galvanized.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 ERECTION

A. Erect structural steel in compliance with AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.

C. Do not field cut or alter structural members without approval of Engineer.

D. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

E. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.03 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION 05 12 00

SECTION 05 31 00
STEEL DECKING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof deck.

B. Supplementary framing for openings up to and including 18 inches.

1.02 RELATED REQUIREMENTS

A. Section 05 12 00 - Structural Steel Framing.

B. Section 05 21 00 - Steel Joist Framing.

C. See Structural Drawings for additional Project Specifications. If Conflicting Project Specifications arise, the Project Specifications on the Structural Drawings govern.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. AWS D1.1/D1.1M - Structural Welding Code - Steel.

D. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel.

E. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel.

F. ICC-ES AC43 - Acceptance Criteria for Steel Deck Roof and Floor Systems.

G. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks.

H. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic").

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.

B. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

C. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.

D. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.

E. Certificates: Certify that products furnished meet or exceed specified requirements.

F. Mill certification for pre-consumer and post-consumer recycled content percentage; request at time of order. Include total weight of material provided.

1.05 QUALITY ASSURANCE

A. Design deck layout, spans, fastening, and joints under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Rhode Island.

B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.3/D1.3M and dated no more than 12 months before start of scheduled welding work.

C. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.

D. Installer Qualifications: Company specializing in performing the work of this Section with minimum ten years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Cut plastic wrap to encourage ventilation.

B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Deck:
   1. Canam Steel Corporation: www.canam-steeljoists.ws.
   2. Cordeck, Inc: www.cordeck.com/#sle.
   3. Nucor-Vulcraft Group: www.vulcraft.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 STEEL DECK

A. All Deck Types: Select and design metal deck in accordance with SDI Design Manual.
   1. Calculate to structural working stress design and structural properties specified.

B. Roof Deck: Non-composite type, fluted steel sheet:
   1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.
   2. Minimum Base Metal Thickness: 20 gauge, 0.0359 inch.
   3. Nominal Height: 1-1/2 inch.

2.03 ACCESSORY MATERIALS

A. Mechanical Fasteners: Steel; hex washer head, self-drilling, self-tapping.
   1. Design Requirements for Sidelap Connections: Provide number and type of fasteners that comply with the applicable requirements of SDI (DM)SDI design method for roof deck and floor deck applications and ICC-ES AC43.

B. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.

PART 3 EXECUTION

3.01 EXAMINATION

3.02 INSTALLATION

A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.

B. On steel supports provide minimum 1-1/2 inch bearing.

C. Fasten deck to steel support members at ends and intermediate supports at 12 inches on center maximum, parallel with the deck flute and at each transverse flute using methods specified.

D. Drive mechanical sidelap connectors completely through adjacent lapped sheets; positively engage adjacent sheets with minimum three-thread penetration.

E. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

END OF SECTION 05 31 00

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel items, including:
   1. Ledge angles, shelf angles, channels and plates.
   2. Loose lintels.

B. Structural supports for miscellaneous attachments

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

B. Section 05 12 00: Structural steel column; base plates and anchor bolts.

C. Section 09 90 00 - Painting and Coating: Paint finish.

D. See Structural Drawings for additional Project Specifications. If Conflicting Project Specifications arise, the Project Specifications on the Structural Drawings govern.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

G. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

H. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

I. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

J. AWS D1.1/D1.1M - Structural Welding Code - Steel.

K. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.

L. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic").

M. SSPC-SP 2 - Hand Tool Cleaning.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

C. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

D. Mill certification for pre-consumer and post-consumer recycled content percentage; request at time of order. Include total weight of material provided.

1.05 QUALITY ASSURANCE

A. Design under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in Rhode Island.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M; or ASTM A 572 / A 572M Grade 50.

B. Plates: ASTM A283; or A 36.

C. Pipe: ASTM A53/A53M, Grade B Schedule 40, black and hot-dip galvanized finish, as indicated. All exterior fabrications to be hot-dip galvanized.

D. Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, galvanized to ASTM A153/A153M where connecting galvanized components.

E. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

G. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic; SSPC-Paint 20, Type II - Organic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by intermittent welds and plastic filler at interior; or continuous welds at exterior.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

A. Bollards: Steel pipe 6" diameter, concrete filled, crowned cap, as detailed; galvanized, primed and painted finish.

B. Ledge Angles, Shelf Angles, Channels, and Plates not attached to Structural Framing: For support of metal decking, joists, and masonry; prime paint or galvanized finish. Galvanized at all exterior locations.

C. Loose Lintels: As detailed; prime paint; galvanized; or de-scaled mill finish. Galvanized at all exterior locations.

D. Structural supports for miscellaneous attachments: As detailed; prime paint; galvanized finish.

2.04 FINISHES - STEEL

A. Prime paint all steel items.
   1. Exceptions: Galvanize all fabrications on the exterior of the building.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: Two coats.

E. Galvanizing of Structural Steel Members exposed to the exterior: Galvanize after fabrication to ASTM A 123/A 123M requirements. Provide minimum 2.0 oz/sq ft galvanized coating.

2.05 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal and aluminum, where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components indicated on drawings and on shop drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION 05 50 00

SECTION 05 52 13
PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted handrails.

B. Stair railings and guardrails.

C. Mesh infill panels.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Placement of anchors in concrete.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

B. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

C. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.

D. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings.

E. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

F. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

PART 2 PRODUCTS

2.01 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of ASTM E985 and applicable local code.

B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935.

C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935.

D. Allow for expansion and contraction of members and building movement without damage to connections or members.

E. Dimensions: See drawings for configurations and heights.

F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

1. For anchorage to concrete, provide inserts to be cast into concrete, for bolting anchors.

G. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.02 STEEL RAILING SYSTEM

A. Steel Tube: ASTM A500/A500M, Grade B cold-formed.

B. Steel Bar: ASTM A500/A500M, Grade B cold-formed.

C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

D. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.

E. Welded Wire Mesh Panel: 8 gauge, 2"x2", 1"x1", 1"x2".

F. Mesh Panel Frame and Clips: 11 gauge.

G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

H. Steel Finishes:
   1. Surface Preparation: Comply with SSPC-SP 1; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust from uncoated steel; comply with SSPC-SP 5.
   2. Pretreatment: Immediately after cleaning, apply a conversion coating of type suited to organic coating applied over it.

2.03 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

D. Welded Joints:
   1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
   2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
   3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Install railings in compliance with ADA Standards for accessible design at applicable locations.

D. Anchor railings securely to structure.

E. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION 05 52 13

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rough opening framing for doors, windows, and roof openings.

B. Sheathing.

C. Roofing nailers.

D. Roofing cant strips.

E. Preservative treated wood materials.

F. Fire retardant treated wood materials.

G. Miscellaneous framing and sheathing.

H. Communications and electrical room mounting boards.

I. Wood nailers and curbs for roofing and items installed on roof.

J. Concealed wood blocking, nailers, and supports.

K. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

B. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 REFERENCE STANDARDS

A. AFPA (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; American Forest and Paper Association.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

C. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

E. AWPA U1 - Use Category System: User Specification for Treated Wood.

F. PS 20 - American Softwood Lumber Standard.

G. SPIB (GR) - Grading Rules.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

C. Product Data: Provide technical data on wood preservative materials and application instructions.

D. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Lumber: Comply with PS 20 and approved grading rules and inspection agencies.

1. Lumber of other species or grades, or graded by other agencies, is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

B. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

C. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

1.06 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Douglas Fir-Larch, unless otherwise indicated.
   2. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   3. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

C. Provide sustainably harvested wood.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: Southern Pine Inspection Bureau, Inc. (SPIB).

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: S-dry or MC19.

D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

E. Miscellaneous Blocking, Furring, Nailers, and Curbs:
   1. Lumber: S4S, No. 1 or Construction Grade.
   2. Boards: Standard.

2.03 CONSTRUCTION PANELS

A. Miscelaneous Exterior Sheathing: Oriented strand board wood structural panel; PS 2.
   1. Grade: Structural 1 Sheathing.
   2. Bond Classification: Exposure 1.
   3. Performance Category: 1/2 PERF CAT.
   4. Span Rating: 32/16.
   5. Edges: Square.

B. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.04 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M; or Stainless Steel for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
3. Anchors: Toggle bolt type for anchorage to hollow masonry.

2.05 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
   2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:
   1. Manufacturers:
      a. Arch Wood Protection, Inc: www.wolmanizedwood.com/#sle.
      b. Hoover Treated Wood Products, Inc: www.frtw.com/#sle.
      c. Osmose, Inc: www.osmose.com/#sle.
      d. Substitutions: Not permitted.
   2. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
      a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
      b. Do not use treated wood in direct contact with the ground.
   3. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
      a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
      b. Treat rough carpentry items as scheduled; or as indicated.
      c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

C. Preservative Treatment:
   1. Manufacturers:
      a. Arch Wood Protection, Inc.: www.wolmanizedwood.com.
      b. Viance, LLC: www.treatedwood.com.
      c. Osmose, Inc: www.osmose.com.
      d. Substitutions: Not permitted.

D. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative to 0.25 lb/cu ft retention.
   1. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
   2. Treat lumber in contact with roofing, flashing, or waterproofing.
   3. Treat lumber in contact with masonry or concrete.
   4. Treat lumber less than 18 inches above grade.
      a. Treat lumber in other locations as indicated.
   5. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative to 0.25 lb/cu ft retention.
      a. Kiln dry plywood after treatment to maximum moisture content of 15 percent.

b. Treat plywood in contact with masonry or concrete.
c. Treat plywood in other locations as indicated.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 FRAMING INSTALLATION

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

D. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

E. Install structural members full length without splices unless otherwise specifically detailed.

F. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AFPA Wood Frame Construction Manual.

3.03 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

E. Specifically, provide the following non-structural framing and blocking:
1. Cabinets and shelf supports.
2. Wall brackets.
3. Handrails.
4. Grab bars.
5. Bath accessories.
6. Wall-mounted door stops.
7. Visual display and marker boards.
8. Wall paneling and trim.
9. Joints of rigid wall coverings that occur between studs.

3.04 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

3.05 INSTALLATION OF ACCESSORIES AND MISCELLANEOUS WOOD

A. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.

B. Coordinate curb installation with installation of decking and support of deck openings, roofing vapor retardant, and parapet construction.

3.06 INSTALLATION OF CONSTRUCTION PANELS

A. Miscelaneous Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using screws.

B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
   2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
   3. Install adjacent boards without gaps.

3.07 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Surface Flatness of Floor: 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

C. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.08 CLEANING

A. Waste Disposal: Comply with the requirements of Section 01 7419 - Construction Waste Management and Disposal.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION 06 10 00

SECTION 06 20 00
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.

B. Hardware and attachment accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide manufacturer's product data, storage and handling instructions for factory-fabricated units.
   2. Provide data on fire retardant treatment materials and application instructions.
   3. Provide instructions for attachment hardware and finish hardware.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

2.02 LUMBER MATERIALS

A. Softwood Lumber: _____ species, _____ sawn, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.

B. Hardwood Lumber: _____ species, _____ sawn, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.

2.03 SHEET MATERIALS

A. Softwood Plywood, Not Exposed to View: Any face species, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.

B. Softwood Plywood, Exposed to View: Face species as indicated, plain sawn, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.

C. Hardwood Plywood: Face species as indicated, plain sawn, book matched, medium density fiberboard core; HPVA HP-1, Front Face Grade AA, Back Face Grade 1, glue type as recommended for application.

D. Prefinished Paneling: _____ face species, _____ cut, _____ grain, V-cut vertical joint scoring; 3/16 inch thick, finished as gloss; _____ manufactured by _____.

E. Particleboard: ANSI A208.1; Composed of wood chips, sawdust, or flakes of medium density, made with waterproof resin binders; of grade to suit application; sanded faces.

F. Hardboard: ANSI A135.4; Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth one side (S1S).

G. Pegboard: Pressed wood fiber with resin binder, standard grade; 1/8 inch thick, with holes spaced at 1 inch on center in both directions.

2.04 PANEL CORE MATERIALS

A. Medium Density Fiberboard (MDF): Composite panel composed of cellulosic fibers, additives, and bonding system; cured under heat and pressure; comply with ANSI A208.2.

B. Basic Hardboard: Panel manufactured from inter-felted lignocellulosic fibers consolidated under heat and pressure; comply with ANSI A135.4.
   1. Class: Tempered; surface: Smooth one side (S1S).

2.05 PLASTIC LAMINATE MATERIALS

A. Plastic Laminate: NEMA LD 3; color as selected by Architect; textured, low gloss finish.

B. Low Pressure Laminate: Melamine; _____ color, _____ pattern and gloss surface texture.

C. Solid Laminate: _____ color, _____ pattern, and gloss surface texture.

2.06 HARDWARE

A. Hardware: Comply with BHMA A156.9.

B. Track and Hanger Systems

2.07 WOOD TREATMENT

A. Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for pressure impregnated wood treatments determined by use categories, expected service conditions, and specific applications.

B. Redry wood after pressure treatment to maximum ____ percent moisture content.

2.08 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. Cap exposed plastic laminate finish edges with material of same finish and pattern.

C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

D. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

3.02 INSTALLATION

A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

D. Install prefinished paneling with full bed contact adhesive applied to substrate.

END OF SECTION 06 20 00

SECTION 07 11 13
BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Bituminous dampproofing.

1.02 RELATED REQUIREMENTS

A. Section 07 21 00 - Thermal Insulation: Rigid insulation board used as protection board.

1.03 REFERENCE STANDARDS

A. ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free.

B. NRCA (WM) - The NRCA Waterproofing Manual.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

C. Product Data: Provide properties of primer, bitumen, and mastics.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application until dampproofing has cured.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Bituminous Dampproofing Manufacturers:
   1. Karnak Corporation: www.karnakcorp.com/#sle.
   2. Mar-Flex Systems, Inc: www.mar-flex.com/#sle.
   3. W. R. Meadows, Inc: www.wrmeadows.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 BITUMINOUS DAMPPROOFING

A. Bituminous Dampproofing: Cold-applied, spray-grade; asphalt base, volatile petroleum solvents, and other content, suitable for application by spray, brush, roller, or squeegee; asbestos-free; suitable for application on vertical and horizontal surfaces.
   1. Composition: ASTM D4479/D4479M Type I, minimum, asbestos free.
   2. VOC Content: Not more than permitted by local, State, and federal regulations.
   3. Applied Thickness: 1/16 inch, minimum, wet film.
   4. Basis of Design Product:
      a. KARNAK; #920AF FIBERED EMULSION MASTIC DAMPPROOFING: www.karnakcorp.com.

B. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting this work.

B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.

C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces not designated to receive dampproofing.

B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.

C. Do not apply dampproofing to surfaces unacceptable to manufacturer.

D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

3.03 APPLICATION

A. Foundation Walls: Apply two coats of asphalt dampproofing.

B. Perform this work in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

C. Prime surfaces in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

D. Apply bitumen with roller.

E. Seal items watertight with mastic, that project through dampproofing surface.

F. Place protection board directly over dampproofing, butt joints, and adhere to tacky dampproofing.

G. Scribe and cut boards around projections, penetrations, and interruptions.

END OF SECTION 07 11 13

SECTION 07 21 00
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at cavity wall construction, perimeter foundation wall, and underside of floor slabs.

B. Board insulation at cavity wall construction.

C. Batt insulation and vapor retarder in exterior wall construction.

D. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

E. Acoustic Batt insulation. See Section 09 21 16 Gypsum Board Assemblies.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 01 74 19 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

C. Section 06 10 00 - Rough Carpentry: Supporting construction for batt insulation.

D. Section 07 53 00 - Elastomeric Membrane Roofing: Installation requirements for board insulation over low slope roof deck specified in this section.

1.03 REFERENCE STANDARDS

A. ASTM C240 - Standard Test Methods for Testing Cellular Glass Insulation Block.

B. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.

C. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

E. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

F. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

G. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

I. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

J. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C.

K. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association.

L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc..

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

C. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

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

1.05 QUALITY ASSURANCE

A. Mock-Up: Provide materials for mock-ups in configurations shown on the drawings.

1.06 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

1.07 SEQUENCING

A. Sequence work to ensure fireproofing, firestop, and vapor retarder materials are in place before beginning work of this section.

1.08 COORDINATION

A. Coordinate the work with Section 07 25 00 for installation of vapor retarder

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 APPLICATIONS

A. Insulation Under Concrete Slabs: Extruded polystyrene board.

B. Insulation at Perimeter of Foundation: Extruded polystyrene board.

C. Insulation Inside Masonry Cavity Walls: Polyisocyanurate board.

D. Insulation in Metal Framed Walls: Batt insulation with integral vapor retarder.

2.03 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene Board Insulation: ASTM C 578, Type IV; Extruded polystyrene board with natural skin surfaces; with the following characteristics:
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
   3. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
   4. Board Size: 48 x 96 inch or 24 X 96 inch.
   5. Board Thickness: 2 inches,
   6. Board Edges: Square, Shiplap or Tongue and groove.
   7. Thermal Conductivity (k factor) at 75 degrees: or 20.
   8. Compressive Resistance: 25 psi and 40 psi.
   9. Board Density: 1.8 lb/cu ft.
   10. Water Absorption, maximum: 0.1 percent, volume.

B. Manufacturers:
   1. Dow Chemical Co(Design Basis):
      a. Cavity Wall - "Cavity Mate Plus", type IV
      b. Foundation and slabs - "Styrofoam Highload 40" type VI.
   2. Owens Corning Corp.
      a. Cavity Wall -"Foamular 250", type IV
      b. Foundation and Slabs - "Foamular 400 SE", type VI.
   3. Pactiv Building Products
      a. Cavity Wall - "Green Board Score Board", type IV
      b. Foundation and Slabs - Type VI.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

C. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
   1. Classifications:
      a. Type I: Faced with aluminum foil on both major surfaces of the core foam.
         1) Class 1 - Non-reinforced core foam.
         2) Compressive Strength: 16 psi, minimum.
         3) Thermal Resistance, R-value: At 1-1/2 inch thick; 9.8 at 75 degrees F.
   2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.

3. Board Size: 16 inch by 96 inch.
4. Board Thickness: 2.0 inch.
5. Products:
    a. Atlas Roofing Corporation; EnergyShield Pro Continuous Wall Insulation: www.atlasroofing.com.
    b. Carlisle Coatings & Waterproofing, Inc; R2+ Matte: www.carlisleccw.com.
    c. DuPont de Nemours, Inc; Thermax Sheathing: building.dupont.com.
    d. Hunter Panels; Xci Foil (Class A): www.hunterpanels.com.
    e. Johns Manville; AP Foil-Faced: www.jm.com.
    f. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 BATT INSULATION MATERIALS

A. Batt Insulation: ASTM C 665; preformed batt; friction fit, conforming to the following:
1. Material: Rock or slag fiber, or glass fiber.
2. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
3. Smoke Developed Index: 50 or less, when tested in accordance with ASTM E84.
4. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
5. Formaldehyde Content: Zero.
6. Thermal Resistance: in accordance with plans.
7. Thickness: Varies.
8. Facing: Aluminum foil, flame spread 25 rated; one side.
9. Manufacturers:
    a. CertainTeed Corporation: www.certainteed.com.
    b. Johns Manville Corporation: www.jm.com.
    c. Owens Corning Corp: www.owenscorning.com.
10. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 ACCESSORIES

A. Tape: Bright aluminum; Polythylene or Polyester self-adhering type, mesh reinforced, 2 inch wide.

B. Insulation Fasteners: Impaling clip of galvanized steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

C. Wire Mesh: Galvanized steel, hexagonal wire mesh.

D. Adhesive: Type recommended by insulation manufacturer for application and in compliance with Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation and adhesive.

B. Verify substrate surfaces are flat, free of irregularities or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Adhere a 6 inch wide strip of polyethylene sheet over construction, control, and expansion joints with double beads of adhesive each side of joint.
1. Tape seal joints.
2. Extend sheet full height of joint.

B. Apply adhesive to back of boards:
1. Three continuous beads per board length.
2. Full bed 1/8 inch thick.

C. Install boards horizontally on foundation perimeter.
1. Place boards to maximize adhesive contact.

2. Install in running bond pattern.
3. Butt edges and ends tightly to adjacent boards and to protrusions.

D. Extend boards over expansion joints, unbonded to foundation on one side of joint.

E. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

F. Immediately following application of board insulation, place protective boards over exposed insulation surfaces.
1. Apply adhesive in five continuous beads per board length.
2. Install boards horizontally from base of foundation to top of insulation.
3. Butt boards tightly, with joints staggered from insulation joints.

3.03 BOARD INSTALLATION AT CAVITY WALLS

A. Install board insulation per manufacturer's instructions.

B. Adhere a 6 inch wide strip of polyethylene sheet over expansion joints with double beads of adhesive each side of joint.
1. Tape seal joints between sheets.
2. Extend sheet full height of joint.

C. Apply compatible adhesive to back of boards:
1. Three continuous beads per board length.
2. Full bed 1/8 inch thick.

D. Install boards to fit snugly between wall ties at 16" O.C.

E. Make insulation continuous, fill all voids with insulation.
1. Place membrane surface against adhesive.
2. Place membrane surface facing out, and tape seal board joints.

F. Install boards horizontally on walls.
1. Place boards to maximize adhesive contact.
2. Install in running bond pattern.
3. Butt edges and ends tightly to adjacent boards and to protrusions.

G. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

H. Place 6 inch wide polyethylene sheet at perimeter of wall openings, from adhesive vapor retarder bed to window, door, and storefront frames. Tape seal in place to ensure continuity of vapor retarder and air seal.

3.04 BOARD INSTALLATION UNDER CONCRETE SLABS

A. Place insulation under slabs on grade after base for slab has been compacted.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.05 BATT INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

B. Install in exterior cavities at window, door, wall and roof spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. Install with factory applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.

F. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

G. At metal framing, place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over member face.

H. Tape seal tears or cuts in vapor retarder.

I. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane. Tape seal in place.

J. Coordinate work of this section with construction of air barrier seal specified in Section 07 27 26.

3.06 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION 07 21 00

SECTION 07 25 00
WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vapor Retarders (Air Barrier and Water Resistive): Materials to make exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls water vapor resistant and air tight.

1.02 RELATED REQUIREMENTS

1.03 DEFINITIONS

A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.

B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.

C. Vapor Retarder: Air tight barrier made of material that is relatively water vapor impermeable, to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.
   1. Water Vapor Permeance: For purposes of conversion, 57.2 ng/(Pa s sq m) = 1 perm.

D. Water-Resistive Barrier: Water-shedding barrier made of material that is moisture resistant, to the degree specified, intended to be installed to shed water without sealed seams.

1.04 REFERENCE STANDARDS

A. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

B. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on material characteristics.

C. Shop Drawings: Provide drawings of special joint conditions.

D. Manufacturer's Installation Instructions: Indicate preparation.

E. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in North Providence School Department's name and registered with installer.

1.06 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain all system components from a single manufacturer.

1.07 MOCK-UP

A. Construct a mock-up panel of size, detail and configuration indicated on the drawings. Mock-up shall include all components of the exterior wall construction.

1.08 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

A. Exterior Vapor Retarder (Air Barrier and Water Resistive):
   1. On outside surface of inside wythe of masonry cavity wall use air barrier and water resistive coating.
   2. On outside surface of sheathing use vapor retarder, air barrier and water resistive coating.

2.02 VAPOR RETARDER MATERIALS (AIR BARRIER AND WATER-RESISTIVE)

A. Vapor Retarder Sheet: ASTM D1970/D1970M.
   1. Type: Rubberized asphalt bonded to thermoplastic sheet, self-adhesive.
   2. Thickness: 40 mil, 0.040 inch, nominal.
   3. Sheet Width: 18 inches, and 36 inches.
   4. Water Vapor Permeance: 0.05 perm, maximum, when tested in accordance with ASTM E96/E96M.
   5. Seam and Perimeter Tape: As recommended by sheet manufacturer.
   6. Manufacturers:
      a. Henry Company; Blueskin SA LT (low temp): www.henry.com/#sle.

2.03 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.

B. Stainless Steel Flashing: Flexible flashing with 8 mil, 0.008 inch thick sheet of Type 304 stainless steel, 8 mil, 0.008 inch of butyl adhesive and a siliconized release liner.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive adhesives in accordance with manufacturer's instructions.

3.03 INSTALLATION

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

B. Vapor Retarders (Air Barrier and Water Resistive): Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Self-Adhered Sheets:
   1. Prepare substrate in manner recommended by sheet manufacturer; fill and tape joints in substrate and between dissimilar materials.
   2. Lap sheets shingle-fashion to shed water and seal laps air tight.
   3. Once sheets are in place, press firmly into substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.
   4. Use same material, or other material approved by sheet manufacturer for the purpose, to seal to adjacent construction and as flashing.
   5. At wide joints, provide extra flexible membrane allowing joint movement.

D. Openings and Penetrations in Exterior Weather Barriers:
   1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
   2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
   3. At openings to be filled with non-flanged frames, seal weather barrier to each side of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.
   4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather barrier to flashing.
   5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
   6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.04 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION 07 25 00

SECTION 07 42 00

METAL WALL PANELS

PART 1 -GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within Division 01 — GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

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

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

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
   1. Factory-formed and field-assembled, acoustic barrier screen metal wall panels for mounting on roof.
   2. C-channels, secondary framing, anchors, and accessories.

B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Northeast Collaborative for High Performance Schools — (NE-CHPS). Project scores will be verified by a third party certifier.
   1. Refer to section 01 81 13 — Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.

C. Related Sections include the following:
   1. Section 05 12 00 — STRUCTURAL STEEL FRAMING, for structural steel supports for metal wall panels.
   2. Section 06 10 00 — ROUGH CARPENTRY for shims, and blocking.
   3. Section 07 90 05 — JOINT SEALANTS for field-applied sealants not otherwise specified in this Section.

1.03 PERFORMANCE REQUIREMENTS

A. General: Provide metal wall panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.

B. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:
   1. General: The intent of these specifications is to meet or exceed the requirements of the local State Building Code, current edition.
   2. Wind Loads: Determine loads based on the following minimum design wind pressures:
      a. Uniform pressure as indicated on Drawings.
   3. Deflection Limits: Engineer metal wall panel assemblies to withstand test pressures with deflection no greater than 1/180 of the span and no evidence of material failure, structural distress, or permanent deformation exceeding 0.2 percent of the clear span.
      a. Test Pressures: 150 percent of inward and outward wind-load design pressures.

C. Seismic Performance: Provide metal wall panel assemblies capable of withstanding the effects of earthquake motions determined according to the local State Building Code.

D. Thermal Movements: Provide metal wall panel assemblies that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.04 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for metal wall panel and accessory.

B. CHPS Submittal: For product specified, fill out the Materials Submittal Cover Sheet — See Section 01 81 13 — Sustainable Design Requirements.

C. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, secondary framing, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.
   1. Accessories. Include details of the following items, at a scale of not less than 6 inches per 12 inches:
      a. Flashing and trim.

D. Calculations: For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Coordination Drawings: Exterior elevations drawn to scale and coordinating penetrations and framing items. Show the following:
   1. Acoustic panels and attachments.
   2. Secondary framing.

F. Samples for Initial Selection: For metal acoustic panel indicated with factory-applied metallic color finishes.
   1. Include similar Samples of trim and accessories involving color selection.
   2. Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.

G. Samples for Verification: For exposed finish required, prepared on Samples of size indicated below.
   1. Metal Wall Panels: 12 inches (300 mm) long by actual panel width. Include C-channels, fasteners, closures, and other metal wall panel accessories.
      a. Provide metal wall panel with C-channel attachment.
   2. Trim and Closures: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
   3. Corner Treatment: 12 inches (300 mm) long each side of corner, by 12 inches (300 mm) high, showing panels, inside and outside corner trim and related accessories.
   4. Accessories: 12-inch- (300-mm-) long Samples for each type of accessory.
   5. Exposed Gaskets: 12 inches (300 mm) long.
   6. Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of metal wall panels adjacent to joint sealants.

H. Qualification Data: For Installer, professional engineer and testing agency.

I. Compatibility and Adhesion Test Reports: From sealant manufacturer indicating the following:
   1. Materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants.
   2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

J. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for the following:
   1. Metal Wall Panels: Include reports for structural and acoustical performance.

K. Maintenance Data: For metal wall panels to include in maintenance manuals.

L. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
   1. Installer's responsibilities include fabricating and installing metal wall panel assemblies and providing professional engineering services needed to assume engineering responsibility.
   2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Fabricator Qualifications: Certified by metal wall panel manufacturer to fabricate and install manufacturer's wall panel system.

C. Installer Qualifications: An employer of workers trained and approved by manufacturer.
   1. Installer's responsibilities include fabricating and installing metal wall panel assemblies and providing professional structural engineering services, certified in the state of Rhode Island, needed to assume engineering responsibility.
   2. Engineering Responsibility: Preparation of data for metal wall panels system, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

D. Testing Agency Qualifications: Required tests shall be performed by agencies qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

E. Source Limitations: Obtain metal wall panel through one source from a single manufacturer.

F. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal wall panels and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

G. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
   1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
      a. Perform tests under environmental conditions replicating those that will exist during installation.
   2. Submit no fewer than nine pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seats, and miscellaneous materials.
   3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to metal acoustic panel assemblies including, but not limited to, the following:
   1. Meet with The Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal wall panel Installer, metal wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal wall panels.
   2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review methods and procedures related to metal wall panel installation, including manufacturer's written instructions.
   4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.

I. Review flashings, and condition of other construction that will affect metal wall panels.

J. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.

K. Review temporary protection requirements for metal wall panel assembly during and after installation.

L. Review wall panel observation and repair procedures after metal wall panel installation.

M. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.

B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect strippable protective covering on metal wall panels from exposure to sunlight and high humidity, except to extent necessary for period of metal wall panel installation.

1.07 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify locations of structural members by field measurements before metal wall panel fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish framing dimensions and proceed with fabricating metal wall panels without field measurements, or allow for field trimming of panels. Coordinate wall construction to ensure that actual building dimensions, locations of structural members, correspond to established dimensions.

1.08 COORDINATION

A. Coordinate metal acoustic panel assemblies with flashing, trim, and construction of girts, studs, and other adjoining work to provide a leak proof, secure, and noncorrosive installation.

1.09 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
    a. Structural failures, including rupturing, cracking, or puncturing.
    b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 ACOUSTIC BARRIER SCREEN METAL WALL PANELS

A. Barrier Wall Panels (Roof Mounted), Exterior:

1. Empire Acoustical Systems “Silent Screen" barrier panel, 12 inches wide; 2-3/4 inch thick, 22-ga., galvanized perforated panel with 16 ga. galvanized steel non-perforated backing,

with 2" mineral rock wool insulation board (6 lb. density) sandwiched between. The panels should be mounted approximately 10 to 16-inches above the roof, refer to Architectural details for additional mounting height requirements.

2. Equal Manufacturers: Kinetics Noise Control, Industrial Acoustics Company.

B. Acoustic Performance:
   1. NRC: 1.05 (ASTM C423).
   2. STC: 35 (ASTM E90).

2.02 METAL FRAMING

A. Provide metal framing and attachment systems, including C-channels, for metal wall panels as recommended by manufacturer to meet indicated design loads.

B. Steel Sheet Components, General: Complying with ASTM C 645 requirements for metal and with ASTM A 653, G60, hot-dip galvanized zinc coating.

C. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.03 FABRICATION

A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
   1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
   2. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel.
   3. Fabricate wall panels with panel stiffeners as required to maintain fabrication tolerances and to withstand design loads.

B. Sheet Metal Accessories: Fabricate trim to comply with architectural details and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
   1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   2. Fabricate attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.
      a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.04 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.
   1. Examine primary structural framing to verify that girts, angles, channels, studs, and other panel support members and anchorage can be installed within alignment tolerances required by metal wall panel manufacturer.
   2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Miscellaneous Framing: Install Z-channels, subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and metal wall panel manufacturer's written recommendations. Coordinate the installation of metal framing elements with air barrier membrane and thermal rigid insulation installation.

3.03 METAL ACOUSTIC PANEL INSTALLATION, GENERAL

A. General: Install metal acoustic panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts, unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Field cutting of metal panels by torch is not permitted.
   2. Shim or otherwise plumb substrates receiving metal wall panels.
   3. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
   4. Install screw fasteners in predrilled holes.
   5. Locate and space fastenings in uniform vertical and horizontal alignment.
   6. Install flashing and trim as metal wall panel work proceeds.
   7. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic acfion by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal wall panel manufacturer.

3.04 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with architectural details, performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Set units true to line and level as indicated.
   1. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.05 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal wall panel units within installed tolerance of 1/4 inch in 20 feet nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.06 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.

B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

D. Touch-up abraded surfaces of adjacent galvanized steel with zinc-rich primer in accordance with Section 05 50 00 — Metal Fabrications.

END OF SECTION 07 42 00

SECTION 07 46 46
FIBER-CEMENT SIDING

PART 1 GENERAL

PART 2 PRODUCTS

2.01 FIBER-CEMENT SIDING

A. Lap Siding: Individual horizontal boards made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
   1. Style: Standard lap style.
   2. Texture: Smooth.
   3. Length: 12 feet, nominal.
   4. Width (Height): 5-1/4 inches.
   5. Thickness: 5/16 inch, nominal.
   6. Finish: Unfinished.
   7. Warranty: 50 year limited; transferable.

B. Panel Siding: Vertically oriented panels made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
   1. Texture: Smooth.
   2. Length (Height): 96 inches, nominal.
   3. Width: 48 inches.
   4. Thickness: 5/16 inch, nominal.
   5. Finish: Factory applied stain.
   6. Warranty: 50 year limited; transferable.

C. Soffit Panels: Smooth panels of same material and finish.

D. Soffit Panels: Panels made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
   1. Texture: Smooth.
   2. Length: 96 inches, nominal.
   3. Width: 48 inches.
   4. Thickness: 5/16 inch, nominal.
   5. Finish: Unfinished.
   6. Manufacturer: Same as siding.

2.02 ACCESSORIES

A. Trim: Same material and texture as siding.

B. Fasteners: Galvanized or corrosion resistant; length as required to penetrate, 1-1/4 inches, minimum.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions and recommendations.
   1. Read warranty and comply with terms necessary to maintain warranty coverage.
   2. Use trim details as indicated on drawings.
   3. Touch up field cut edges before installing.
   4. Pre-drill nail holes if necessary to prevent breakage.

B. Joints in Horizontal Siding: Avoid joints in lap siding except at corners; where joints are inevitable stagger joints between successive courses.

C. Joints in Vertical Siding: Install Z-flashing in horizontal joints between successive courses of vertical siding.

D. Do not install siding less than 6 inches from ground surface, or closer than 1 inch to roofs, patios, porches, and other surfaces where water may collect.

E. After installation, seal joints except lap joints of lap siding; seal around penetrations, and paint exposed cut edges.

END OF SECTION 07 46 46

SECTION 07 54 00
THERMOPLASTIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Adhered system with thermoplastic roofing membrane. EPDM or TPO

B. Insulation, flat and tapered.

C. Vapor retarder.

D. Cover boards.

E. Flashings.

F. Walkway pads.

1.02 RELATED REQUIREMENTS

A. Section 05 31 00 - Steel Decking: Product requirements for acoustical insulation for deck flutes, for placement by this section.

B. Section 06 10 00 - Rough Carpentry: Wood nailers and curbs.

C. Section 06 10 00 - Rough Carpentry: Wood cant strips.

D. Section 07 62 00 - Sheet Metal Flashing and Trim: Counterflashings and reglets.

E. Section 07 72 00 - Roof Accessories: Roof-mounted units; prefabricated curbs.

1.03 REFERENCE STANDARDS

A. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

B. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

C. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing.

D. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

E. FM DS 1-28 - Wind Design.

F. NRCA (RM) - The NRCA Roofing Manual.

G. NRCA (WM) - The NRCA Waterproofing Manual.

H. UL (FRD) - Fire Resistance Directory.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Conference: Conduct conference at Project site. Review methods and procedures related to roofing system including, but not limited to, the following:

1. Meet with Owner; roofing Installer; roofing system manufacturer's representative; and installers whose work interfaces with or affects roofing, including installers of roof accessories.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.

9. Review roof observation and repair procedures after roofing installation.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, fasteners, and cover board and other system components.

C. Shop Drawings: Submit drawings that indicate joint or termination detail conditions, conditions of interface with other materials, setting plan for tapered insulation, and paver layout.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.

F. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions given.

G. Manufacturer's qualification statement.

H. Installer's qualification statement.

I. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

J. Warranty Documentation:
   1. Submit manufacturer warranty and ensure that forms have been completed in North Providence School Department's name and registered with manufacturer.
   2. Submit installer's certification that installation complies with warranty conditions for waterproof membrane.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum twenty years of documented experience.

B. Installer Qualifications: Company specializing in performing work of this section with at least ten years of documented experience.

1.07 PERFORMANCE REQUIREMENTS

A. General: Provide installed roofing system that remains watertight; does not permet the pasage of water; resists specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and applicatin required, as demonstrated by roofming memvrane manufacturer based on testing and field experience.

C. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requiremetns in FMG 4450 and FMG 4470 as part of a membrane roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
   1. Fire/Windstorm Classification: Class 1A-90.
   2. Hair Resistance: MH.

D. Wind Load: Provide roofing system complying with the load requirements of the International Building Code as identified on the Structural Drawings and as follows:
   1. Untimate Design Wind Speed: 150 mph.
   2. Nominal Design Wind Speed: 116 mph.
   3. Risk Category: III.
   4. Wind Exposure Category: C.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.

B. Store materials in weather protected environment, clear of ground and moisture.

C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

D. Protect foam insulation from direct exposure to sunlight.

1.09 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.

B. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

D. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.10 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Provide Manufacturer full system warranty, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
   1. Warranty includes roofing membrane, base flashings, roofing memtrane accessories, roof insulation, fasteners, protective boards, sheathing, vapor retarder, walkway products and other components of membrane roofing system.
   2. Warranty Period: 20 years, NDL, from date of Substantial Completion.
   3. Wind Load: Warranty shall cover wind speed and wind loads indicated on the Structural Drawings and as noted herein.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Thermoplastic Polyolefin (TPO) Membrane Roofing Materials:
   1. Carlisle Roofing Systems, Inc: www.carlisle-syntec.com.
   2. Firestone Building Products, LLC: www.firestonebpco.com.
   3. GAF; EverGuard TPO: www.gaf.com.
   4. GenFlex Roofing Systems, LLC: www.genflex.com.
   5. Johns Manville: www.jm.com.
   6. Versico Roofing Systems: www.versico.com.
   7. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation:
   1. Carlisle SynTec: www.carlisle-syntec.com.
   2. Firestone Building Products, LLC: www.firestonebpco.com.
   3. GAF: www.gaf.com/#sle.
   4. Johns Manville: www.jm.com.
   5. Versico Roofing Systems; SecurShield Insulation: www.versico.com.
   6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ROOFING - UNBALLASTED APPLICATIONS

A. Thermoplastic Membrane Roofing: One ply, 60 mil, 0.060 inch, minimum, TPO or EPDM membrane, fully adhered, over vapor retarder, insulation and cover board.

B. Roofing Assembly Requirements:
   1. Solar Reflectance Index (SRI): 78, minimum, calculated in accordance with ASTM E1980.
      a. Field applied coating may not be used to achieve specified SRI.
      b. Color: White
   2. Roof Covering External Fire Resistance Classification: UL (FRD) Class A.

3. Factory Mutual Classification: Class 1 and windstorm resistance of 1-90, in accordance with FM DS 1-28.
4. Insulation Thermal Resistance (R-Value): R-30, minimum.

2.03 MEMBRANE ROOFING AND ASSOCIATED MATERIALS

A. Membrane Roofing Materials:
   1. TPO: Thermoplastic polyolefin (TPO) complying with ASTM D6878/D6878M, sheet contains reinforcing fabrics or scrims.
   2. EPDM: Ethylene propylrnr diene monomer complying with ASTM D6878/D6878M, sheet contains reinforcing fabrics or scrims.
      a. Thickness: 60 mil, 0.060 inch, minimum.
   3. Sheet Width: Factory fabricated into largest sheets possible.
   4. Solar Reflectance: 0.75, minimum, initial, and 0.65, minimum, 3-year, certified by Cool Roof Rating Council.
   5. Color: White.

B. Seaming Materials: As recommended by membrane manufacturer.

C. Vapor Retarder: Material approved by roof manufacturer complying with requirements of fire rating classification; compatible with roofing and insulation materials.
   1. Fire-retardant adhesive.

D. Flexible Flashing Material: Same material as membrane.

2.04 COVER BOARDS

A. Cover Boards: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.
   1. Thickness: 1/2 inch, fire-resistant.
   2. Products:
      a. Georgia-Pacific; DensDeck Prime with EONIC Technology: www.densdeck.com.
      b. National Gypsum Company; DEXcell FA Glass Mat Roof Board:
      c. USG Corporation; Securock Ultralight Glass-Mat Roof Board: www.usg.com.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 INSULATION

A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
   1. Classifications:
      a. Type II:
         1) Class 1 - Faced with glass fiber reinforced cellulosic felt facers on both major surfaces of core foam.
         2) Compressive Strength: Classes 1-2-3, Grade 1, 16 psi (110 kPa), minimum.
         3) Thermal Resistance: R-36 minimum.
   2. Board Size: 48 by 96 inches.
   3. Board Thickness: Thickness as required to acheive minimum thermal resistance, two layers, minimum. inches.
   4. Tapered Board: Slope as indicated; minimum thickness 1/2 inch; fabricate of fewest layers possible.
   5. Board Edges: Square.

2.06 ACCESSORIES

A. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.

B. Cant and Edge Strips: Wood fiberboard, compatible with roofing materials; cants formed to 45 degree angle.

C. Sheathing Adhesive: Noncombustible type, for adhering gypsum sheathing to metal deck.

D. Membrane Adhesive: As recommended by membrane manufacturer.

E. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.

F. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.

G. Insulation Adhesive: As recommended by insulation manufacturer.

H. Sealants: As recommended by membrane manufacturer.

I. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
   1. Composition: Roofing membrane manufacturer's standard.
   2. Size: 24 by 24 inches.
   3. Surface Color: White.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 INSTALLATION, GENERAL

A. Perform work in accordance with manufacturer's instructions, NRCA (RM), and NRCA (WM) applicable requirements.

B. Do not apply roofing membrane during cold or wet weather conditions.

C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.

D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

3.03 INSTALLATION - VAPOR RETARDER AND INSULATION, UNDER MEMBRANE

A. Install vapor retarder to deck surface with adhesive in accordance with manufacturer's instructions.
   1. Extend vapor retarder under cant strips and blocking to deck edge.
   2. Install flexible flashing from vapor retarder to air seal material of wall construction, lap and seal to provide continuity of the air barrier plane.

B. Ensure vapor retarder is clean and dry, continuous, and ready for application of insulation.

C. Attachment of Insulation: Embed insulation in adhesive in full contact, in accordance with roofing and insulation manufacturers' instructions.

D. Cover Boards: Embed cover boards in adhesive in full contact, in accordance with roofing and insulation manufactures' instructions.

E. Lay subsequent layers of insulation with joints staggered minimum 6 inches from joints of preceding layer.

F. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.

G. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

H. At roof drains, use factory-tapered boards to slope down to roof drains over a distance of 18 inches.

I. Do not install more insulation than can be covered with membrane in same day.

3.04 INSTALLATION - MEMBRANE

A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

B. Shingle joints on sloped substrate in direction of drainage.

C. Fully Adhered Application: Apply adhesive to substrate in accordance with membrane manufacturer's instructions. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.

D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

E. At intersections with vertical surfaces:
   1. Extend membrane over cant strips and up a minimum of 8 inches onto vertical surfaces.
   2. Fully adhere flexible flashing over membrane and up to nailing strips.

F. Around roof penetrations, seal flanges and flashings with flexible flashing.

G. Coordinate installation of roof drains and sumps and related flashings.

3.05 INSTALLATION - WALKWAY PADS

A. Install walkway pads in accordance with manufacturer's instructions.

3.06 CLEANING

A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.

B. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.

C. Remove bituminous markings from finished surfaces.

D. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

E. Repair or replace defaced or damaged finishes caused by work of this section.

3.07 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION 07 54 00

SECTION 07 61 00
SHEET METAL SIDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sheet metal siding, associated flashings, and underlayment.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on metal types, finishes, characteristics.

C. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

D. Installation Samples: Submit two samples 12 by 12 inch in size illustrating metal roofing mounted on plywood backing illustrating typical seam.

E. Color Samples: Submit two samples 12 by 12 inch in size illustrating metal finish color.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) requirements and standard details, except as otherwise noted.
   1. Maintain one copy on project site.

B. Installer Qualifications: Company specializing in performing sheet metal roof installations with minimum 5 years of experience.

1.05 MOCK-UP

A. Construct mock-up of sheet metal roofing, 4 feet long by 8 feet wide, illustrating associated attachments.

B. Mock-up may remain as part of the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion. Defective work includes degradation of metal finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sheet Metal Siding Manufacturers:
   1. AmeriZinc, by IMETCO.
   2. RHEINZINK Canada Ltd.
   3. VM Zinc.

B. Basis of Design: VM Zinc, VMZ Adeka Zinc Panels; or approved equal.

2.02 SHEET MATERIALS

A. Zinc Alloy Sheet/Coils
   1. Titanium Zinc Alloy whose base is electrolytic high grade fine zinc (DIN EN1179) with a 99.995 % Zn degree of purity and alloying additives of + 0.1% copper and + 0.1% titanium in accordance with DIN EN 988.

a. Pre-Weathered: pickling process (no phosphating)
1) Color: As selected by Architect from manufacturer's full range.
2. Minimum Panel Thickness: 1.0 mm.
3. Minimum Flashing Thickness: 0.7 mm (24 ga.)

B. Ventilation Mat at Titanium Zinc: Provide manufacturer's approved ventilation mat equal to Enkamat 7010 or Enkamal 7008; by Colbond.
1. Ventilation mat adequately functions as slipsheet. Do not use red rosin paper as underlayment to zinc as this causes corrosion.

2.03 MISCELLANEOUS METAL FRAMING FOR METAL PANELS

A. Provide metal framing and attachment systems for metal wall panels as recommended by manufacturer to meet indicated design loads.

B. Steel Sheet Components, General: Complying with ASTM C 645 requirements for metal and with ASTM A 653, G60, hot-dip galvanized zinc coating.

C. Subgirts: C- or Z-shaped sections fabricated from 0.0598-inch (1.5-mm) bare steel thickness, shop-painted, cold-formed, galvanized steel sheet.

D. Z-Shaped Furring Hat Channels: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), galvanized steel with minimum bare metal thickness of 0.0598-inch (1.5-mm), and depth required to fit insulation thickness indicated.

E. J-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), galvanized steel with minimum bare metal thickness of 0.0598-inch (1.5-mm), and depth required to fit insulation thickness indicated.
1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.04 MISCELLANEOUS MATERIALS

A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating.
1. Fasteners for Wall Panels: Self-drilling or self-tapping 410 stainless or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal wall panels.
2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
4. Clips: Manufacturer's standard clips as required for installation of panels.

B. Panel Sealants:
1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant. ASTM C 1311.

C. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.05 ACCESSORIES

A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.

1. Closures: Provide head closure piece and closures at eaves and rakes, fabricated of same metal and thickness as metal wall panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

B. Insect Mesh: Fused, entangled polymer filaments heat-bonded to each other fo form a rigid mat comprising an open, three-dimensional geomatrix.
   1. Product:
      a. Colbond Industries, Enkamat, or equal by approved manufacturer.

C. Custom Closure, Flashing and Trim: Formed from same gauge as panels. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fascia, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

2.06 FABRICATION

A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
   1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
   2. Fabricate wall panels with panel stiffeners as required to maintain fabrication tolerances and to withstand design loads.

B. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel

D. Exposed Mitered/Welded Corners shall be fabricated from same gauge as panels. These corners shall be furnished in the same profile and width as the panels. Leg length of each corner shall be 13".

E. Where indicated, fabricate metal wall panel joints with factory-installed captive gaskets or separa- tor strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will minim- ize noise from movements within panel assembly.

F. Sheet N)etal Accessories: fabricate flashing and trim to comply with recommendations in SMAC- NA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
   1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
   3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
   4. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
   5. Exterior only: Conceal fasteners and expansion provisions where possible. Exposed fasten- ers are not allowed on faces of accessories exposed to view.
   6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.
      a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.07 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a stripp- able, temporary protective covering before shipping.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.
   1. Examine primary and secondary wall framing to verify that girls, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
   2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work

B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected

3.02 PREPARATION

A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.

B. Install flashings and other sheet metal to comply with requirements specified in Section 076200 — SHEET METAL FLASHING AND TRIM.

C. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

D. Coordinate work with the installation of air vapor barrier specified in Section 072500 — Air Barriers, and mineral wool insulation specified in Section 072100 — Thermal Insulation.

3.03 METAL WALL PANEL INSTALLATION, GENERAL

A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Field cutting of metal wall panels by torch is not permitted.
   2. Shim or otherwise plumb substrates receiving metal wall panels.
   3. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
   4. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
   5. Install concealed screw fasteners in predrilled holes.
   6. Locate and space fastenings in uniform vertical and horizontal alignment.
   7. Install flashing and trim as metal wall panel work proceeds.
   8. Locate panel splices over, but not attached to, structural supports. Stagger panel Splices and end laps to avoid a four-panel lap splice condition.
   9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
   10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.

11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls

B. Concealed Fasteners:
   1. Steel Wall Panels: Use stainless-steel fasteners for surfaces exposed to the exterior and galvanized steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal wall panel manufacturer.

D. Joint Seaters: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.
   1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
   2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

E. Provide support framing where not indicated to be provided by others.

3.04 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal wall panel assembly including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer’s written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
   1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.05 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal wall panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.06 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed metal wall panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal wall panels where inspections indicate that they do not comply with specified requirements.

C. Additional tests and inspections, at Contractor’s expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.07 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer’s written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.

B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 61 00

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings and counterflashings.

B. Reglets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood nailers.

B. Section 07 72 00 - Roof Accessories: Manufactured metal roof curbs.

C. Section 07 90 05 - Joint Sealers.

D. Section 08 62 23 - Tubular Skylishts: Integral metal curbs.

1.03 REFERENCE STANDARDS

A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

C. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

F. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

G. SMACNA (ASMM) - Architectural Sheet Metal Manual.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

1.05 MOCK-UP

A. Construct a mock-up panel of size, detail and configuration indicated on the drawings. Mock-up shall include all components of the exterior wall construction.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA Architectural Sheet Metal Manual requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with ten years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 0.050 inch thick; plain finish shop pre-coated with modified silicone coating.
   1. Modified Silicone Polyester Coating: Pigmented Organic Coating System, AAMA 2603; baked enamel finish system.
   2. Color: As selected by Architect from manufacturer's standard colors.

B. Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 28 gauge, (0.0156 inch) thick; smooth No. 4 - Brushed finish.

2.02 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.

B. Primer: Zinc chromate type.

C. Protective Backing Paint: Zinc molybdate alkyd.

D. Sealant: Specified in Section 07 90 05.

E. Plastic Cement: ASTM D4586, Type I.

2.03 FABRICATION

A. Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that appl to design, dimensions, metal, and other characteristics of item indicated. Shop-fabricate items where practicable. Optain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet meta flashing and trim in thickness or weight needed to comply iwth performance requiremtns, but not less than that specified for each application and material.

C. Fabricate sheet metal flashing and trim without excessive oil canning, cuckling, and tool marks and true to line and levels indicated, with exposed edges colded back to form mens.

D. Form sections true to shape, accurate in size, square, and free from distortion or defects.

E. Form pieces in longest possible lengths.

F. Hem exposed edges on underside 1/2 inch; miter and seam corners.

G. At non-moving joints, form material with flat lock seams, except where otherwise indicated. tin edges to be seamed, form seams, and solder.

H. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

I. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

J. conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherise indicated.

K. Fabricate cleats and attachment devices from te same material as acceossory being anchored or from compatible, noncorrosive metal.

L. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.

2.04 ROOF EDGE SHEET METAL FABRICATION

A. Fascia: Fabricate in minimum 96 inch long sections.
   1. Joint Style: Back plate formed to fit behind fascia profile.
   2. Profile: As indicated on the drawings.
   3. Fabricate from pre-finished aluminum as specified herein, above.

2.05 WALL SHEET METAL FABRICATIONS

A. Flasing for Openings in Frame Construction: Fabricate head, sill, and similar flashings with 4 inch minimum extension beyond wall openings at each end. Form with 2 inch high end dams

and back dams. Extend past face of wall an turn down with hemmed edge. Fabricate from the following material:

1. Stainless Steel: Type 304, 26ga.

B. Through-Wall Flashing and Drip Edges in Masonry Construction: Fabricate continuous flashings in minimum 96 inch lengths, but not exceding 12 foot long. Fabricate discontinuous lintel, sill and similar flashings to extend 8 inghes beyond each side of wall openings. Form with 2 inch high end dams. Extend past face of wall and turn down with hemmed edge. Fabricated from the following material:

1. Stainless Steel: Type 304, 26ga.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

A. Conform to drawing details.

B. Insert flashings into reglets to form tight fit. Secure in place with lead wedges. Pack remaining spaces with lead wool. Seal flashings into reglets with sealant.

C. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.

D. Apply plastic cement compound between metal flashings and felt flashings.

E. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

F. Seal metal joints watertight.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for field inspection requirements.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION 07 62 00

SECTION 07 71 00

ROOF SPECIALTIES

PART 1 GENERAL

PART 2 PRODUCTS

2.01 COMPONENTS

A. Roof Edge Flashings: Factory fabricated to sizes required; corners mitered; concealed fasteners.
   1. Configuration: Fascia, cant, and edge securement for roof membrane.
   2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test methods RE-1 and RE-2 to positive and negative design wind pressure as defined by applicable local building code.
   3. Exposed Face Height: As indicated on drawings.
   4. Material: Formed aluminum sheet, 0.050 inch thick, minimum.

B. Copings: Factory fabricated to sizes required; corners mitered; concealed fasteners.
   1. Configuration: Concealed continuous hold down cleat at both legs; internal splice piece at joints of same material, thickness, and finish as cap; concealed stainless steel fasteners.
   2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-3 to positive and negative design wind pressure as defined by applicable local building code.
   3. Wall Width: As indicated on drawings.
   4. Outside Face Height: As indicated on drawings.
   5. Inside Face Height: As indicated on drawings.
   6. Material: Formed aluminum sheet, 0.040 inch thick, minimum.

C. Factory Fabricated Cornices: Factory fabricated, assembled, and finished sheet metal architectural details, including profiles, returns, mitered corners, end caps, rakes, gables, etc; finished unit mechanically fastened to structural support.

D. Control and Expansion Joint Covers: Composite construction of ____-inch wide flexible EPDM flashing of white color with closed cell urethane foam backing, each edge seamed to aluminum sheet metal flanges, designed for nominal joint width of 1 inch. Include special formed corners, tees, intersections, and wall flashings, each sealed watertight.

E. Pipe and Penetration Flashing: Base of rounded aluminum, compatible with sheet metal roof systems, and capable of accomodating pipes sized between 3/8 inch and 12 inches.
   1. Caps: EPDM.
   2. Color: As indicated on drawings.

F. Engineered Roof Perimeter Blocking: Prefabricated 20-gauge, 0.036-inch galvanized steel retainer for lightweight concrete; with cleat to accept copings; attach to roof deck in lieu of wood blocking at roof edge; for low slope roof installations.

G. Counterflashings: Factory fabricated and finished sheet metal that overlaps top edges of base flashing by at least 4 inches, and designed to snap into through-wall flashing or reglets with lapped joints.
   1. Material: Formed aluminum sheet, 0.025 inch thick, minimum.
   2. Finish: Mill finish aluminum.

H. Pipe Penetration Wall Seal: Seal for HVAC piping wall penetrations with wall mounted rigid plastic outlet cover and elastomeric wall seal gasket.
   1. Wall Outlet Size, Stucco and Masonry Applications: 7-1/2 inches wide by 10 inches high.
      a. Elastomeric Sleeve Diameter: 1-11/16 inches.
   2. Outlet Cover Color: Gray.

I. Pipe Penetration Wall Seal and Insulated Piping Protection System: Seal for HVAC piping wall penetrations with wall mounted rigid plastic outlet cover and elastomeric wall seal gasket and having mechanical line insulation with PVC protective cover.
   1. Wall Outlet Size, Stucco and Masonry Applications: 7-1/2 inches wide by 10 inches high.

a. Elastomeric Sleeve Diameter: 1-11/16 inches with applicable insulation thickness and PVC protective cover.

2. Outlet Cover Color: Gray.
3. PVC Insulation Cover Color: Black with full-length velcro fastener.

2.02 FINISHES

A. Clear Anodized Finish: AAMA 611 AA-M12C22A41 Class I clear anodic coating not less than 0.7 mil, 0.0007 inch thick.

B. Color Anodized Finish: AAMA 611 AA-M12C22A42/44 Class I integrally or electrolytically colored anodic coating not less than 0.7 mil, 0.0007 inch thick.

C. Baked Enamel: Pigmented Organic Coating System, AAMA 2603; polyester baked enamel finish system; color as indicated.

D. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system; color as indicated.

E. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; color as indicated.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install components in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

END OF SECTION 07 71 00

SECTION 07 72 00
ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured equipment rails, and pedestals.

B. Non-penetrating pedestals and rails.

C. Roof curbs.

1.02 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.

C. Shop Drawings: Submit detailed layout developed for this project. Show dimensioned location and number for each type of roof accessory.

D. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

E. Warranty Documentation:
   1. Submit manufacturer warranty.
   2. Ensure that forms have been completed in North Providence School Department's name and registered with manufacturer.
   3. Submit documentation that roof accessories accessories are acceptable to roofing manufacturer, and do not limit the roofing warranty.

1.04 DELIVERY, STORAGE, AND HANDLING

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

B. Store products under cover and elevated above grade.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURED CURBS

2.02 NON-PENETRATING ROOFTOP SUPPORTS/ASSEMBLIES

A. Non-Penetrating Rooftop Assemblies: Manufacturer-engineered and factory-fabricated, with pedestal bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly.
   1. Design Loadings and Configurations: As required by applicable codes.
   2. Height: Provide minimum clearance of 8 inches under supported items to top of roofing.
   3. Support Spacing and Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
   4. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
   5. Hardware, Bolts, Nuts, and Washers: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A153/A153M.
   6. Set non-penetrating support assemblies on walkway pad.

B. Non-Penetrating Pedestals: Pedestals with square, round, or rectangular bases.
   1. Bases: High density polypropylene or UV stable, reinforced PVC.

2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
3. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
4. Condensate Piping:
    a. Shim condensate piping with plastic spacers as required to maintain positive slope to drain. Secure spacers to prevent movement.
    b. Strap condensate piping to pedestal.
5. Accessories: Provide support pad at each pedestal.
6. Manufacturers:
    a. Miro industries, Inc.; Pillow Block: www.miroind.com.
    b. Portals Plus; Pedestal Plus: www.portalsplus.com/#sle.
    c. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

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

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing weather integrity.

3.04 CLEANING

A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.

B. Clean installed work to like-new condition.

3.05 PROTECTION

A. Protect installed products until completion of project.

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

END OF SECTION 07 72 00

SECTION 07 84 00
FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of all joints and penetrations in fire-resistance rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS

A. Section 01 70 00 - Execution and Closeout Requirements: Cutting and patching.

B. Section 09 21 16 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.

C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

D. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies.

E. ITS (DIR) - Directory of Listed Products.

F. FM 4991 - Approval Standard for Firestop Contractors.

G. FM P7825 - Approval Guide; Factory Mutual Research Corporation.

H. SCAQMD 1168 - Adhesive and Sealant Applications.

I. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems.

J. UL (FRD) - Fire Resistance Directory.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

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

F. Certificate from authority having jurisdiction indicating approval of materials used.

G. Qualification statements for installing mechanics.

H. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

1.05 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Listing in the current-year classification or certification books of UL, FM, or ITS (Warnock Hersey) will be considered as constituting an acceptable test report.
   2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
   3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and:
   1. Approved by Factory Mutual Research under FM Standard 4991, Approval of Firestop Contractors, or meeting any two of the following requirements:.
   2. With minimum 5 years documented experience installing work of this type.
   3. Able to show at least 3 satisfactorily completed projects of comparable size and type.
   4. Licensed by authority having jurisdiction.
   5. Approved by firestopping manufacturer.

D. Installing Mechanic's Qualifications: Trained by firestopping manufacturer and able to provide evidence thereof.

1.06 MOCK-UP

A. Install one firestopping assembly representative of each fire rating design required on project.
   1. Where one design may be used for different penetrating items or in different wall constructions, install one assembly for each different combination.
   2. Where firestopping is intended to fill a linear opening, install minimum of 2 linear ft.

B. Obtain approval of authority having jurisdiction before proceeding.

C. If accepted, mock-up will represent minimum standard for the Work.

D. If accepted, mock-up may remain as part of the Work. Remove and replace mock-ups not accepted.

1.07 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 FIRESTOPPING - GENERAL REQUIREMENTS

A. Manufacturers:
   1. A/D Fire Protection Systems Inc: www.adfire.com.
   2. 3M Fire Protection Products: www.3m.com/firestop.
   3. Hilti, Inc: www.us.hilti.com.
   4. Nelson FireStop Products: www.nelsonfirestop.com.

B. Firestopping Materials with Volatile Content: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

2.02 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Head-of-Wall Firestopping at Joints Between Non-Rated Floor and Fire-Rated Wall: Use any system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.
   1. Movement: In addition, provide systems that have been tested to show movement capability as indicated.

B. Floor-to-Floor, Wall-to-Wall, and Wall-to-Floor Joints, Except Perimeter, Where Both Are Fire-Rated: Use any system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
   1. Movement: In addition, provide systems that have been tested to show movement capability as indicated.
   2. Air Leakage: In addition, provide systems that have been tested to show L Rating as indicated.

3. Watertightness: In addition, provide systems that have been tested to show W Rating as indicated.
4. Listing by UL, FM, or Intertek in their certification directory will be considered evidence of successful testing.

C. Through Penetration Firestopping: Use any system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
1. Temperature Rise: In addition, provide systems that have been tested to show T Rating as indicated.
2. Air Leakage: In addition, provide systems that have been tested to show L Rating as indicated.
3. Listing by UL, FM, or Intertek in their certification directory will be considered evidence of successful testing.

2.03 FIRESTOPPING FOR FLOOR-TO-FLOOR, WALL-TO-FLOOR, AND WALL-TO-WALL JOINTS

A. Concrete and Concrete Masonry Walls and Floors:
1. Top of Wall Joints at Concrete/Concrete Masonry Wall to Concrete Over Metal Deck Floor:
a. 2 Hour Construction: UL System HW-D-0181; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
b. 2 Hour Construction: UL System HW-D-1037; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
2. Concrete/Concrete Masonry Wall to Wall Joints:
a. 2 Hour Construction: UL System WW-D-0017; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
b. 2 Hour Construction: UL System WW-D-0032; Hilti CP 606 Flexible Firestop Sealant.

B. Gypsum Board Walls:
1. Wall to Wall Joints:
a. 2 Hour Construction: UL System WW-D-0067; Hilti CP 606 Flexible Firestop Sealant.
b. 1 Hour Construction: UL System WW-D-0067; Hilti CP 606 Flexible Firestop Sealant.

2.04 FIRESTOPPING PENETRATIONS THROUGH CONCRETE AND CONCRETE MASONRY CONSTRUCTION

A. Blank Openings:
1. In Walls:
a. 2 Hour Construction: UL System C-AJ-0090; Hilti FS-ONE Intumescent Firestop Sealant.

B. Penetrations Through Walls By:
1. Multiple Penetrations in Large Openings:
a. 2 Hour Construction: UL System C-AJ-8143; Hilti FS-ONE Intumescent Firestop Sealant.
2. Uninsulated Metallic Pipe, Conduit, and Tubing:
a. 2 Hour Construction: UL System C-AJ-1421; Hilti FS-ONE Intumescent Firestop Sealant or CP 604 Self-Leveling Firestop Sealant.
b. 2 Hour Construction: UL System C-AJ-1498; Hilti CP 680-P/M Cast-In Device.
3. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
a. 2 Hour Construction: UL System C-AJ-2109; Hilti CP 643N/644 Firestop Collar.
b. 2 Hour Construction: UL System C-BJ-2021; Hilti CP 643N Firestop Collar.
4. Electrical Cables Not In Conduit:
a. 2 Hour Construction: UL System C-AJ-3216; Hilti CP 658 Firestop Plug.
b. 2 Hour Construction: UL System W-J-3198; Hilti CFS-SL RK Retrofit Sleeve Kit for existing cables.
c. 2 Hour Construction: UL System W-J-3199; Hilti CFS-SL SK Firestop Sleeve Kit.
5. Cable Trays with Electrical Cables:

a. 3 Hour Construction: UL System C-AJ-4035; Hilti FS-ONE Intumescent Firestop Sealant.

6. Insulated Pipes:
   a. 2 Hour Construction: UL System C-AJ-5048; Hilti FS-ONE Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CP 601S Elastomeric Firestop Sealant, or CP 604 Self-Leveling Firestop Sealant.
7. HVAC Ducts, Uninsulated:
   a. 2 Hour Construction: UL System C-AJ-7111; Hilti FS-ONE Intumescent Firestop Sealant.
   b. 2 Hour Construction: UL System C-AJ-7084; Hilti FS-ONE Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CP 601S Elastomeric Firestop Sealant, or CP 604 Self-Leveling Firestop Sealant.

C. Penetrations Through Walls By:
1. Uninsulated Metallic Pipe, Conduit, and Tubing:
   a. 2 Hour Construction: UL System W-J-1067; Hilti FS-ONE Intumescent Firestop Sealant.
2. Electrical Cables Not In Conduit:
   a. 2 Hour Construction: UL System W-J-3060; Hilti FS-ONE Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CD 601S Elastomeric Firestop Sealant, or CP 618 Firestop Putty Stick.
   b. 2 Hour Construction: UL System W-J-3143; Hilti CP 658T Firestop Plug.
3. Insulated Pipes:
   a. 2 Hour Construction: UL System W-J-5041; Hilti FS-ONE Intumescent Firestop Sealant.
   b. 2 Hour Construction: UL System W-J-5042; Hilti FS-ONE Intumescent Firestop Sealant.
   c. 2 Hour Construction: UL System W-J-5028; Hilti FS-ONE Intumescent Firestop Sealant.
4. HVAC Ducts, Uninsulated:
   a. 2 Hour Construction: UL System W-J-7109; Hilti FS-ONE Intumescent Firestop Sealant or CP 606 Flexible Firestop Sealant.
5. HVAC Ducts, Insulated:
   a. 2 Hour Construction: UL System W-J-7112; Hilti FS-ONE Intumescent Firestop Sealant.

2.05 FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS

A. Blank Openings:
1. 2 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.

B. Penetrations By:
1. Multiple Penetrations in Large Openings:
   a. 2 Hour Construction: UL System W-L-1389; Hilti FS-ONE Intumescent Firestop Sealant.
   b. 2 Hour Construction: UL System W-L-1408; Hilti FS-ONE Intumescent Firestop Sealant.
   c. 2 Hour Construction: UL System W-L-8071; Hilti FS-ONE Intumescent Firestop Sealant.
   d. 2 Hour Construction: UL System W-L-8079; Hilti FS-ONE Intumescent Firestop Sealant.
   e. 2 Hour Construction: UL System W-L-8087; Hilti FS 657 Fire Block.
2. Uninsulated Metallic Pipe, Conduit, and Tubing:
   a. 2 Hour Construction: UL System W-L-1054; Hilti FS-ONE Intumescent Firestop Sealant.
   b. 2 Hour Construction: UL System W-L-1164; Hilti FS-ONE Intumescent Firestop Sealant.

c. 2 Hour Construction: UL System W-L-1206; Hilti FS-ONE Intumescent Firestop Sealant.

3. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
   a. 2 Hour Construction: UL System W-L-2078; Hilti CP 643N/644 Firestop Collar.
   b. 2 Hour Construction: UL System W-L-2411; Hilti CP 648-E Firestop Wrap Strip.
   c. 2 Hour Construction: UL System W-L-2128; Hilti FS-ONE Intumescent Firestop Sealant.
4. Electrical Cables Not In Conduit:
   a. 2 Hour Construction: UL System W-L-3065; Hilti FS-ONE Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CD 601S Elastomeric Firestop Sealant, or CP 618 Firestop Putty Stick.
   b. 2 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
   c. 2 Hour Construction: UL System W-L-3393; Hilti CFS-SL RK Retrofit Sleeve Kit for existing cables.
   d. 2 Hour Construction: UL System W-L-3394; Hilti CFS-SL SK Firestop Sleeve Kit.
   e. 2 Hour Construction: UL System W-L-3395; Hilti CP653 Speed Sleeve.
5. Cable Trays with Electrical Cables:
   a. 2 Hour Construction: UL System W-L-4011; Hilti FS 657 Fire Block.
   b. 2 Hour Construction: UL System W-L-4060; Hilti FS-ONE Intumescent Firestop Sealant.
6. Insulated Pipes:
   a. 2 Hour Construction: UL System W-L-5028; Hilti FS-ONE Intumescent Firestop Sealant.
   b. 2 Hour Construction: UL System W-L-5029; Hilti FS-ONE Intumescent Firestop Sealant.
   c. 2 Hour Construction: UL System W-L-5096; Hilti FS-ONE Intumescent Firestop Sealant.
   d. 2 Hour Construction: UL System W-L-5257; Hilti FS-ONE Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, or CP 601S Elastomeric Firestop Sealant.
   e. 2 Hour Construction: UL System W-L-5244; Hilti CP 648-E Firestop Wrap Strip.
7. HVAC Ducts, Insulated:
   a. 2 Hour Construction: UL System W-L-7156; Hilti FS-ONE Intumescent Firestop Sealant.

2.06 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements. Foam, caulk, putty or manufactured device.
   1. Fire Ratings: Use any system listed by UL, FM, or ITS (Warnock Hersey) or that has F Rating equal to fire rating of penetrated assembly and minimum T Rating of 0 and that meets all other specified requirements.
   2. Fire Ratings: See Drawings for required systems and ratings.

B. Firestopping at Uninsulated Metallic Pipe and Conduit Penetrations, of diameter 4 inches or less: Any material meeting requirements. Foam, caulk, putty or manufactured device.

C. Firestopping at Cable Tray Penetrations: Any material meeting requirements. Foam, caulk, putty or manufactured device.

D. Firestopping at Cable Penetrations, not in Conduit or Cable Tray: Any material meeting requirements. Foam, caulk, putty or manufactured device.

E. Firestopping at Control and Expansion Joints (without Penetrations): Any material meeting requirements and caulk.

2.07 MATERIALS

A. Firestopping Sealants: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

B. Elastomeric Silicone Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.

C. Foam Firestoppping: Single component silicone foam compound.

D. Fibered Compound Firestopping: Formulated compound mixed with incombustible non-asbestos fibers.

E. Fiber Firestopping: Mineral fiber insulation used in conjunction with elastomeric surface sealer forming airtight bond to opening.

F. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to arrest liquid material leakage.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authority having jurisdiction.

C. Install labeling required by code.

CLEANING

4.01 CLEAN ADJACENT SURFACES OF FIRESTOPPING MATERIALS.

4.02 PROTECTION

A. Clean adjacent surfaces of firestopping materials.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION 07 84 00

SECTION 07 90 05
JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sealants and joint backer rods.

B. Precompressed foam sealers.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 REFERENCE STANDARDS

A. ASTM C834 - Standard Specification for Latex Sealants.

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

C. ASTM C1193 - Standard Guide for Use of Joint Sealants.

D. ASTM D1056 - Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.

E. ASTM D1667 - Standard Specification for Flexible Cellular Materials--Poly(Vinyl Chloride) Foam (Closed-Cell).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with other sections referencing this section.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

C. Samples: Submit two samples, 2 x 1/2 in size illustrating sealant colors for selection.

D. Manufacturer's Installation Instructions: Indicate special procedures, surface preparation, and perimeter conditions requiring special attention.

E. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

1.06 QUALITY ASSURANCE

A. Maintain one copy of each referenced document covering installation requirements on site.

1.07 MOCK-UP

A. Construct a mock-up panel of size, detail and configuration indicated on the drawings. Mock-up shall include all components of the exterior wall construction.

1.08 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.09 COORDINATION

A. Coordinate the work with all sections referencing this section.

1.10 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 SEALANTS

A. Sealants and Primers - General: Provide products having volatile organic compound (VOC) content as specified in Section 01 61 16.

B. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
   1. Color: Standard colors matching finished surfaces.
   2. Applications: Use for:
      a. Interior wall and ceiling control joints.
      b. Joints between door and window frames and wall surfaces.
      c. Other interior joints for which no other type of sealant is indicated.
   3. Products:
      a. Pecora Corporation; AC-20 + Silicone Acrylic Latex Caulking Compound: www.pecora.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Silicone Sealant: ASTM C920, Grade NS, Class 25 minimum; Uses NT, A, G, M, O; single component, neutral curing, non-sagging, non-staining, fungus resistant, non-bleeding.
   1. Color: To be selected by Architect from manufacturer's full range.
   2. Movement Capability: Plus and minus 25 percent.
   3. Service Temperature Range: -65 to 180 degrees F.
   4. Shore A Hardness Range: 15 to 35.
   5. Products:
      a. Pecora Corporation; 890NST Ultra Low Modulus Architectural Silicone Sealant - Class 100: www.pecora.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces and joint openings are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Install bond breaker where joint backing is not used.

D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Tool joints concave.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION

A. Protect sealants until cured.

END OF SECTION 07 90 05

SECTION 07 95 13

EXPANSION JOINT COVER ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Expansion joint assemblies for floor, wall, ceiling and soffit surfaces.

1.02 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices.

C. Manufacturer's Installation Instructions: Indicate rough-in sizes; provide templates for cast-in or placed frames or anchors; required tolerances for item placement.

D. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

PART 2 PRODUCTS

2.01 EXPANSION JOINT COVER ASSEMBLY APPLICATIONS

A. Interior Floor Joints:
   1. Basis-of-Design: Emseal Joint Systems Ltd.: Migutrans FSL 77/35
   2. Recess mount with inset to receive florring material
   3. Where floor finish material is different on each side of the joint, feather the slab on the side of the thinner material to provide flush transition across joint.

B. Interior Wall/Ceiling Jints:
   1. Basis-of-Design: Balco, Inc.: 6GW Series
   2. Recess mount with surface flush to gypsum wall board.

2.02 EXPANSION JOINT COVER ASSEMBLIES

A. Expansion Joint Cover Assemblies - General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.
   1. Joint Cover Sizes: Selected to suit joint width and configuration, based on manufacturer's published recommendations and limitations.
   2. Lengths: Provide covers in full lengths required; avoid splicing wherever possible.
   3. Anchors, Fasteners, and Fittings: Provided by cover manufacturer.

B. Floor Joint Covers: Coordinate with indicated floor coverings.

2.03 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper; or ASTM B308/B308M, 6061 allow, T6 temper.
   1. Exposed Finish at Floors: Natural anodized.
   2. Exposed Finish at Walls and Ceilings: Natural anodized.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.

3.02 PREPARATION

A. Provide anchoring devices for installation and embedding.
   1. Provide templates and rough-in measurements.

3.03 INSTALLATION

A. Install components and accessories in accordance with manufacturer's instructions.

B. Align work plumb and level, flush with adjacent surfaces.

C. Rigidly anchor to substrate to prevent misalignment.

3.04 SCHEDULE

A. Provide floor, wall and ceiling expansion joint covers at all corridor connections to existing building. Six locations.

3.05 PROTECTION

A. Do not permit traffic over unprotected floor joint surfaces.

B. Provide strippable coating to protect finish surface.

END OF SECTION 07 95 13

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated steel door frames.

B. Non-fire-rated steel doors.

C. Steel frames for wood doors.

D. Fire-rated steel doors and frames.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 01 78 39 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

C. Section 08 71 00 - Door Hardware.

D. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.

E. Section 09 90 00 - Painting and Coating: Field painting.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council.

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100).

D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

F. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.

G. ASTM C476 - Standard Specification for Grout for Masonry.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

I. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames.

J. DHI A115 Series - Specifications for Steel Doors and Frame Preparation for Hardware; Door and Hardware Institute (ANSI/DHI A115 Series).

K. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames.

L. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.

D. Samples: Submit two samples of metal, 2 x 2 inches in size showing factory finishes, colors, and surface texture.

E. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

F. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

G. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

C. Maintain at the project site a copy of all reference standards dealing with installation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in accordance with NAAMM HMMA 840.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Door Frames:
   1. Assa Abloy Ceco, Curries, or Fleming: www.assaabloydss.com/#sle.
   2. Mesker, dormakaba Group: www.meskeropeningsgroup.com/#sle.
   3. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
   4. Steelcraft: www.steelcraft.com.
   5. Phillip Manufacturing Company
   6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DOORS AND FRAMES

A. Requirements for All Door Frames:
   1. Accessibility: Comply with ANSI/ICC A117.1.
   2. Finish: Factory primed, for field finishing.

2.03 STEEL DOORS

A. Exterior Doors :
   1. Grade: ANSI A250.8 Level 3, physical performance Level A, Model 1, full flush.
   2. Core: Polyurethane.
      a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
   3. Door Thermal Resistance: R-Value of 6.0 minimum, for installed thickness of polystyrene.
   4. Door Thickness: 1-3/4 inches, nominal.
   5. Top Closures for Outswinging Doors: Flush with top of faces and edges.
   6. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A60/ZF180 coating.
   7. Texture: Smooth faces.
   8. Weatherstripping: Separate, see Section 08 71 00.
   9. Glazing: Seperate, see Section 08 80 00.
   10. Finish: Factory primed, for field finishing.

2.04 STEEL FRAMES

A. General:
   1. Comply with the requirements of grade specified for corresponding door.
      a. Frames for Wood Doors: Comply with frame requirements specified in ANSI A250.8 for Level 1, 16 gage
   2. Finish: Factory primed, for field finishing.
   3. Frames Wider than 48 Inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

B. Exterior Door Frames: Fully welded.
   1. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A60/ZF180 coating.
   2. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
   3. Finish: Factory primed, for field finishing.
   4. Weatherstripping: Integral, recessed into door edge or frame.

C. Interior Door Frames, Non-Fire-Rated: Fully welded type.
   1. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
   2. Finish: Factory primed, for field finishing.

D. Door Frames, Fire-Rated: Full profile/continuously welded type.
   1. Fire Rating: Same as door, labeled.
   2. Terminated Stops: Provide at interior doors; closed end stop terminated 6 inch, maximum, above floor at 45 degree angle.
   3. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
   4. Finish: Factory primed, for field finishing.

E. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

F. Mullions for exterior Pairs of Doors: Removable type, with profile similar to jambs.

G. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.

H. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inch high to fill opening without cutting masonry units.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil, 0.015 inch dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
   1. Fire-Rated Frames: Comply with fire rating requirements indicated.

2.06 ACCESSORY MATERIALS

A. Glazing: As specified in Section 08 80 00, factory installed.

B. Astragals for Double Doors: Specified in Section 08 71 00.
   1. Exterior Doors: Steel, Z-shaped.

C. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.

D. Silencers: Resilient rubber or vinyl, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

E. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.

2.07 FINISH MATERIALS

A. Primer: Rust-inhibiting, complying with ANSI A250.10, door manufacturer's standard, baked on.

B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation. 8 mil D.F.T.

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Coordinate frame anchor placement with wall construction.

C. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

D. Coordinate installation of hardware.

E. Comply with glazing installation requirements of Section 08 80 00.

F. Coordinate installation of electrical connections to electrical hardware items.

G. Touch up damaged factory finishes.

3.04 TOLERANCES

A. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

3.06 SCHEDULE - SEE DRAWINGS

END OF SECTION 08 11 13

SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; fire rated, non-rated, and acoustical.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 01 78 39 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

C. Section 08 11 13 - Hollow Metal Doors and Frames.

D. Section 08 71 00 - Door Hardware.

E. Section 08 80 00 - Glazing.

1.03 REFERENCE STANDARDS

A. ANSI A135.4 - American National Standard for Basic Hardboard.

B. ICC (IBC) - International Building Code; 2003.

C. UBC Std 7-2, Part II - Test Standard for Smoke- and Draft-control Assemblies; International Conference of Building Officials; 1997.

D. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

E. WDMA I.S. 1A - Interior Architectural Wood Flush Doors.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Samples of Initial Selection: Submit two sample sets illustrating manufacturer's full range of stain colors.

D. Samples for Verification: Submit two samples of door veneer, 6 by 6 inches in size illustrating wood grain, stain color, and sheen.

E. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, factory finishing criteria, identify cutouts for glazing.

F. Manufacturer's Installation Instructions: Indicate special installation instructions.

G. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

H. Specimen warranty.

I. Warranty, executed in North Providence School Department's name.

1.05 QUALITY ASSURANCE

A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than five years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.07 PROJECT CONDITIONS

A. Coordinate the work with door opening construction, door frame and door hardware installation.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Interior Doors: Provide manufacturer's warranty for the life of the installation.

C. Provide warranty for the following term:
   1. Interior Doors: Warranty - Provide for replacing, including cost of rehanging and refinishing, at no cost to Owner, wood doors exhibiting defects in materials or workmanship including warp and delaminating for the life of installation.

D. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:
   1. Algoma Hardwoods Inc.
   2. Graham Wood Doors: www.grahamdoors.com.
   3. Eggers Industries: www.eggersindustries.com/#sle.
   4. VT Industries www.VTindustries.com
   5. Marshfield DoorSystems, Inc: www.marshfielddoors.com/#sle.
   6. VT Industries, Inc.
   7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DOORS

A. All Doors: See drawings for locations and additional requirements.
   1. Quality Level: Premium Grade, Heavy Duty performance, in accordance with WDMA I.S.1-A.
   2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
   3. Door slabs to be STC 40.
   4. Certified Wood: Provide 100 percent of all wood based materials and products certified in accordance with the Forest Stewardship Council's (FSC) principles and Criteria.

B. Interior Doors: 1-3/4 inches; thick unless otherwise indicated; flush construction.
   1. Provide solid composite lumber core doors at all locations , except acoustical door.
   2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with International Building Code ("positive pressure"); UL or WH (ITS) labeled without any visible seals when door is open.
   3. Smoke and Draft Control Doors : In addition to required fire rating, provide door assemblies tested in accordance with UBC Standard 7-2, Part II; with "S" label; if necessary, provide additional gasketing or edge sealing.
   4. Wood veneer facing with factory transparent finish .

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type structural composite lumber core (SCLC), plies and faces as indicated above.

B. Fire Rated Doors: Mineral core, Type FD, plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

C. Sound Resistant Doors: Equivalent to type, with particleboard core (PC) construction with core as required to achieve STC rating specified; plies and faces as indicated above.

2.04 DOOR FACINGS

A. Wood Veneer Facing for Transparent Finish: White Maple, Premium, Grade A veneer faces.
   1. Cut: Rift Sawn.
   2. Veneer match: Slip Match.
   3. Vertical Edges: Same species as face veneer.
   4. "Running Match" each pair of doors and doors in close proximity to each other.
   5. "Pair Match" doors hung in same opening or separated only by mullions.
   6. Transoms: Continuous match to doors.

B. Facing Adhesive: Type II - water resistant.

2.05 ACCESSORIES

A. Glazing Stops: Wood, of same species as door facing, butted; or mitered corners; prepared for countersink style tamper proof screws.

2.06 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:
   1. Provide solid blocks at lock edge for hardware reinforcement.
   2. Provide solid blocking for other through bolted hardware.

C. Fit door edge trim to edge of stiles after applying veneer facing.

D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

F. Provide edge clearances in accordance with the quality standard specified.

2.07 FACTORY FINISHING - WOOD VENEER DOORS

A. Factory finish doors in accordance with specified quality standard:
   1. Transparent Finish: Transparent catalyzed polyurethane, Premium quality, semi-gloss sheen.

B. Factory finish doors in accordance with approved sample.

C. Seal door top edge with color sealer to match door facing.

2.08 ACCESSORIES

A. Glazing: See Section 08 80 00.

B. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.

C. Astragals for Fire-Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge, specifically for double doors.

D. Door Hardware: See Section 08 71 00.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

E. Coordinate installation of glazing.

3.03 TOLERANCES

A. Conform to specified quality standard for fit and clearance tolerances.

B. Conform to specified quality standard for telegraphing, warp, and squareness.

C. Maximum Diagonal Distortion (Warp): 1/8 inch measured with straight edge or taut string, corner to corner, over an imaginary 36 by 84 inches surface area.

D. Maximum Vertical Distortion (Bow): 1/8 inch measured with straight edge or taut string, top to bottom, over an imaginary 36 by 84 inches surface area.

E. Maximum Width Distortion (Cup): 1/8 inch measured with straight edge or taut string, edge to edge, over an imaginary 36 by 84 inches surface area.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.05 SCHEDULE

A. See Door Schedule on the drawings.

END OF SECTION 08 14 16

SECTION 08 31 00
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall access door and frame units.

B. Ceiling access door and frame units.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 01 78 39 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

C. Section 09 90 00 - Painting and Coating: Field paint finish.

1.03 REFERENCE STANDARDS

A. ITS (DIR) - Directory of Listed Products.

B. UL (FRD) - Fire Resistance Directory.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Manufacturer's Installation Instructions: Indicate installation requirements.

D. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years documented experience.

PART 2 PRODUCTS

2.01 ACCESS DOOR AND PANEL APPLICATIONS

A. Walls, Unless Otherwise Indicated:
   1. Material: Steel.
   2. Size: 18 x18 inches, unless otherwise indicated.
   3. Standard duty, hinged door.
   4. Tool-operated spring or cam lock; no handle.
   5. In All Wall Types: Surface mounted face frame and door surface flush with frame surface.
   6. In Gypsum Board: Drywall bead frame with door surface flush with wall surface.
   7. In Plaster: Drywall bead frame with door surface flush with wall surface.
   8. In Masonry: Surface mounted frame with door surface flush with frame surface.
   9. In Masonry: Frameless with door surface recessed for infill with wall finish.

B. Walls in Wet Areas:
   1. Material: Steel, hot-dipped galvanized.
   2. Size: 18 x18 inches, unless otherwise indicated.
   3. Standard duty, hinged door.
   4. Tool-operated spring or cam lock; no handle.
   5. In All Wall Types: Surface mounted face frame and door surface flush with frame surface.
   6. In Gypsum Board: Drywall bead frame with door surface flush with wall surface.
   7. In Plaster: Drywall bead frame with door surface flush with wall surface.
   8. In Masonry: Surface mounted frame with door surface flush with frame surface.

C. Fire Rated Walls: See drawings for wall fire ratings.
   1. Material: Steel.
   2. Size: 18 x18 inches, unless otherwise indicated.
   3. Insulated, double skin door panel.
   4. Tool-operated spring or cam lock; no handle.

D. Ceilings, Unless Otherwise Indicated: Same type as for walls.
   1. Material: Steel.
   2. Size in Lay-in Grid Ceilings: To match grid module.
   3. Size in Other Ceilings: 18 x18 inches, unless otherwise indicated.
   4. Standard duty, hinged door.
   5. Tool-operated spring or cam lock; no handle.

E. Fire Rated Ceilings: See drawings for ceiling fire ratings.
   1. Material: Steel.
   2. Size: 18 x 18 inches, unless otherwise indicated.
   3. Standard duty, hinged door.
   4. Tool-operated spring or cam lock; no handle.

2.02 WALL AND CEILING UNITS

A. Manufacturers:
   1. Acudor Products Inc: www.acudor.com/#sle.
   2. Cendrex, Inc: www.cendrex.com/#sle.
   3. Karp Associates, Inc: www.karpinc.com/#sle.
   4. Milcor by Commercial Products Group of Hart & Cooley, Inc: www.milcorinc.com/#sle.

B. Access Doors: Factory fabricated door and frame units, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies units are to be installed in.
   1. Door Style: Single thickness with rolled or turned in edges.
   2. Double-Skinned Hollow Steel Door Panels: 16 gage, 0.059 inch, minimum, on both sides and all edges.
   3. Units in Fire Rated Assemblies: Fire rating as required by applicable code for the fire rated assembly in which they are to be installed.
   4. Steel Finish: Primed.
   5. Primed Finish: Polyester powder coat; manufacturer's standard color.
   6. Hardware:
      a. Hardware for Fire Rated Units: As required for listing.
      b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
      c. Handle: Fixed.
      d. Latch/Lock: Tamperproof tool-operated cam latch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings are correctly sized and located.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings. Secure rigidly in place.

C. Position units to provide convenient access to the concealed work requiring access.

END OF SECTION 08 31 00

SECTION 08 33 23

OVERHEAD COILING DOORS

PART 1 GENERAL

1.01 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for purpose specified.

PART 2 PRODUCTS

2.01 COILING DOORS

A. Exterior Coiling Doors Type ___: Steel slat curtain.
   1. Capable of withstanding positive and negative wind loads of 20 psf without undue deflection or damage to components.
   2. Single Thickness Slats: Manufacturer's standard.
      a. Vision Lites: Single pane glazed.
   3. Sandwich slat construction with insulated core of foamed-in-place polyurethane insulation; minimum R-value of 8.1.
      a. Vision Lites: Dual pane glazed.
   4. Nominal Slat Size: 2 inches wide by required length.
   5. Vent Slats: Manufacturer's standard, in locations indicated on drawings.
   6. Finish: Galvanized.
   7. Finish: No. 4 - Brushed.
   8. Finish: Anodized, _____ color.
   9. Finish: Factory painted, _____ color.
   10. Hood Enclosure: Manufacturer's standard; primed steel.
   11. Electric operation.
   12. Locking Devices: Lock and latch handle on outside.

B. Interior Non-Fire-Rated Coiling Doors Type ___: Steel slat curtain.
   1. Single Thickness Slats: Manufacturer's standard.
      a. Vision Lites: Single pane glazed.
   2. Nominal Slat Size: 2 inches wide by required length.
   3. Vent Slats: Manufacturer's standard, in locations indicated on drawings.
   4. Finish: Primed.
   5. Finish: No. 4 - Brushed.
   6. Finish: Anodized, _____ color.
   7. Finish: Factory painted, _____ color.
   8. Hood Enclosure: Manufacturer's standard; primed steel.
   9. Electric operation.
   10. Locking Devices: Lock and latch handle on outside.

C. Fire-Rated Coiling Doors: Steel slat curtain; comply with NFPA 80.
   1. 1-1/2 hour fire rating.
      a. Provide smoke and draft control door assemblies tested in accordance with UL 1784.
   2. Provide products listed and labeled by ITS (DIR) or UL (DIR) as suitable for purpose specified and indicated on drawings.
   3. Oversized Openings: Provide certificate of compliance from authorities having jurisdiction indicating approval of fire rated units and operating hardware assembly.
   4. Single thickness slats.
   5. Nominal Slat Size: 2 inches wide by required length.
   6. Finish: Primed.
   7. Finish: No. 4 - Brushed.
   8. Finish: Factory painted, color as selected.
   9. Hood Enclosure: Manufacturer's standard; primed steel.
   10. Electric operation.

11. Locking Devices: Lock and latch handle on outside.

2.02 MATERIALS AND COMPONENTS

A. Metal Curtain Construction: Interlocking slats.
   1. Curtain Bottom for Slat Curtains: Fitted with angles to provide reinforcement and positive contact in closed position.
   2. Weatherstripping for Exterior Doors: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.
   3. Smoke Seals: Provide brush or gasket type weatherstripping seals to prevent passage of smoke and hot gases in compliance with UL 1784 testing requirements.
   4. Steel Slats: Minimum thickness, ___ gauge, ___ inch; ASTM A653/A653M galvanized steel sheet.
      a. Galvanizing: Minimum G90 coating.
   5. Stainless Steel Slats: Minimum thickness, ___ gauge, ___ inch, complying with ASTM A 666, Type 304, rollable temper.
   6. Single Wall Aluminum Slats: Minimum thickness; manufacturer's standard for door size and application, made from ASTM B221 (ASTM B221M), aluminum alloy Type 6063.

B. Guide Construction: Continuous, of profile to retain door in place with snap-on trim, mounting brackets of same metal.

C. Guides - Angle: ASTM A36/A36M metal angles, size as indicated.
   1. Hot-dip galvanized in compliance with ASTM A123/A123M.
   2. Stainless Steel: ASTM A 666, Type 304, rollable temper.

D. Guides - Sheet Metal: Formed from sheet metal, ___ gauge, ___ inch thick; ___ inch wide.
   1. Stainless Steel: ASTM A 666, Type 304, rollable temper.

E. Hood Enclosure and Trim: Internally reinforced to maintain rigidity and shape.

F. Lock Hardware:
   1. Cylindrical Locking Mechanism: Latchset lock cylinder, specified in Section 08 71 00.
   2. Latching Mechanism: Inside mounted, adjustable keeper, spring activated latch bar feature to keep in locked or retracted position.
   3. Latch Handle: Manufacturer's standard.

2.03 ELECTRIC OPERATION

A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
   1. Provide interlock switches on motor operated units.

B. Electric Operators:
   1. Mounting: Side mounted.
   2. Motor Enclosure:
   3. Motor Rating: 1/3 HP; continuous duty.
   4. Motor Voltage: 120 volts, single phase, 60 Hz.
   5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
   6. Controller Enclosure: NEMA 250, Type 4.
   7. Opening Speed: 12 inches per second.
   8. Brake: Manufacturer's standard type, activated by motor controller.
   9. Manual override in case of power failure.
   10. See Section 26 27 17 for electrical connections.

C. Control Station: Provide standard three button, "Open-Close-Stop" momentary-contact control device for each operator complying with UL 325.
   1. 24 volt circuit.
   2. Surface mounted, at interior door jamb.
   3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.

a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.

D. Safety Edge: Located at bottom of coiling door, full width, electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object, hollow neoprene covered.

E. Fabric Curtain Safety Edge: Located at bottom of curtain, full width, electro-mechanical sensitized type, with internal wireless transmitter signaling controller to stop and reverse door direction upon striking object.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install fire-rated doors in accordance with NFPA 80.

C. Install smoke door assemblies in accordance with NFPA 105.

D. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

E. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

F. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

G. Coordinate installation of electrical service with Section 26 27 17.

H. Complete wiring from disconnect to unit components.

I. Install enclosure and perimeter trim.

END OF SECTION 08 33 23

SECTION 08 43 13
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Aluminum doors .

C. Weatherstripping.

1.02 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware: Hardware items other than specified in this section.

B. Section 08 80 00 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site.

B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

F. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

G. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, internal drainage details .

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.

D. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

E. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

F. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

G. Manufacturer Qualifications Statement.

H. Installer Qualifications Statement.

I. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

J. Warranty: Submit manufacturer warranty and ensure forms have been completed in North Providence School Department's name and registered with manufacturer.

1.06 MOCK-UP

A. Construct a mock-up panel of size, detail and configuration indicated on the drawings. Mock-up shall include all components of the exterior wall construction.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing aluminum glazing systems with minimum 20 years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least 10 years of documented experience and approved by manufacturer.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.09 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.10 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide fifteen year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Aluminum-Framed Storefronts Manufacturers:
   1. Architectural Window Manufacturing Corporation
   2. EFCO Corporation: www.efcocorp.com/#sle.
   3. Kawneer North America: www.kawneer.com/#sle.
   4. Oldcastle BuildingEnvelope: www.oldcastlebe.com/#sle.
   5. Tubelite, Inc: www.tubeliteinc.com/#sle.
   6. Vistawall Architectural Products.
   7. YKK AP America Inc: www.ykkap.com.

2.02 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING

A. Center-Set Style, Thermally-Broken:
   1. Basis of Design: Kawneer 501T.
   2. Inset Operating Window: Kawneer GLASSVent, Project-Out.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 BASIS OF DESIGN -- SWINGING DOORS

A. Exterior Doors: Wide Stile, 1" Insulating Glazing, Thermally-Broken:
   1. Basis of Design: Kawneer 560 Insulclad Thermal Entrance with 10" bottom rail.
   2. Thickness: 2-1/4 inches.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Finish: Superior performing organic coatings.
      a. Factory finish all surfaces that will be exposed in completed assemblies.
      b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
      c. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
   2. Finish Color: As selected from manufacturer's standards.
   3. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   4. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
   6. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
   7. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
   8. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

B. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.
   1. Design Wind Loads: Comply with the requirements of IBC 2018 code.

C. Performance Requirements
   1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
      a. Design Wind Loads: Comply with requirements of ASCE 7.
      b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
   2. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf pressure difference.

2.05 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
   1. Glazing stops: Flush.

B. Glazing: As specified in Section 08 80 00.

C. Swing Doors: Glazed aluminum.
   1. Thickness: 2-1/4 inches.
   2. Top Rail: 6 inches wide.
   3. Vertical Stiles: 6 inches wide.
   4. Bottom Rail: 10 inches wide.
   5. Glazing Stops: Square.
   6. Finish: Same as storefront.

D. Operable Sash: Aluminum project-out awning; finished to match storefront; turn handle latch with manufacturer's standard insect screen.

2.06 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Fasteners: Stainless steel.

C. Perimeter Sealant: Specified in Section 07 90 05.

D. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.07 FINISHES

A. Superior Performing Organic Coatings System: Manufacturer's standard multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch.

B. Color: To match existing storefront systems, one color.

2.08 HARDWARE

A. For each door, include weatherstripping, sill sweep strip, and threshold.

B. Other Door Hardware: As specified in Section 08 71 00.

C. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

D. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.

E. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.

F. Hinges: Butt type, swing clear; top and bottom.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Coordinate attachment and seal of perimeter air and vapor barrier materials.

I. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

J. Install operating sash.

K. Set thresholds in bed of mastic and secure.

L. Install hardware using templates provided.
   1. See Section 08 71 00 for hardware installation requirements.

M. Install glass and infill panels in accordance with Section 08 80 00, using glazing method required to achieve performance criteria.

N. Install perimeter sealant in accordance with Section 07 90 05.

O. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 ft, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.05 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

C. Remove excess sealant by method acceptable to sealant manufacturer.

3.06 PROTECTION

A. Protect installed products from damage during subsequent construction.

END OF SECTION 08 43 13

SECTION 08 51 13
ALUMINUM WINDOWS

PART 1 GENERAL

PART 2 PRODUCTS

2.01 BASIS OF DESIGN - AW PERFORMANCE CLASS WINDOWS

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 having Performance Class of AW, and Performance Grade at least as high as specified design pressure.

B. Fixed, Thermally-Broken:
   1. Basis of Design: Boyd Aluminum; Series 4000 Fixed, 4 inch deep frame, Thermally Broken: www.boydaluminum.com/#sle.

C. Projected, Face of Sash and Frame in Approximately Same Plane:
   1. Basis of Design: Boyd Aluminum; Series 4400, Project Out Casement, 4 inch deep frame, Thermally Broken: www.boydaluminum.com/#sle.

2.02 BASIS OF DESIGN - CW PERFORMANCE CLASS WINDOWS

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 having Performance Class of CW, and Performance Grade at least as high as specified design pressure.

B. Hung Windows, Vertically Sliding; with Matching Fixed Units:
   1. Basis of Design: _____.

2.03 ALUMINUM WINDOWS

A. Aluminum Windows: Extruded aluminum frame and sash, factory fabricated, factory finished, with operating hardware, related flashings, and anchorage and attachment devices.
   1. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for operating hardware and imposed loads.
   2. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
   3. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
   4. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

B. Fixed, Non-Operable Type:
   1. Construction: Thermally broken.
   2. Glazing: Double; gray tinted; low-e.
   3. Exterior Finish: Class I natural anodized.
   4. Interior Finish: Class I natural anodized.

C. Inswinging Hopper Type:
   1. Construction: Thermally broken.
   2. Provide screens.
   3. Glazing: Double; gray tinted; low-e.
   4. Exterior Finish: Class I natural anodized.
   5. Interior Finish: Class I natural anodized.

2.04 PERFORMANCE REQUIREMENTS

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
   1. Performance Class (PC): R.
   2. Performance Grade (PG): 15, with minimum design pressure (DP) of 15.04 psf.

B. Wind-Borne-Debris Resistance: Identical full-size glazed assembly without auxiliary protection, tested by independent agency in accordance with ASTM E1996 for Wind Zone 4 - Additional Protection for Large and Small Missile impact and pressure cycling at design wind pressure.

C. Water Leakage: No uncontrolled leakage on interior face when tested in accordance with ASTM E331 at differential pressure of 12.11 psf.

D. Air Leakage: 0.1 cfm/sq ft maximum leakage per unit area of outside window frame dimension when tested at 1.57 psf pressure difference in accordance with ASTM E283/E283M.

E. Condensation Resistance Factor of Frame: 50, measured in accordance with AAMA 1503.

F. Forced Entry Resistance: Tested to comply with ASTM F588 requirements for performance level of Grade 10 for specific window style required.

2.05 COMPONENTS

A. Frames: ____ inch wide by ____ inch deep profile, of ____ inch thick section; thermally broken with interior portion of frame insulated from exterior portion; flush glass stops of snap-on type.

B. Operable Sash Weatherstripping: Wool pile; permanently resilient, profiled to achieve effective weather seal.

C. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

2.06 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Sheet Aluminum: ASTM B209/B209M, 5005 alloy, H12 or H14 temper.

C. Concealed Steel Items: Profiled to suit mullion sections; galvanized in accordance with ASTM A123/A123M.

2.07 HARDWARE

A. Sash lock: Lever handle with cam lock.
   1. Provide ___ feet long pole handle.

2.08 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41, clear anodic coating not less than 0.7 mil thick.

B. Class II Natural Anodized Finish: AAMA 611 AA-M12C22A31, clear anodic coating not less than 0.4 mil thick.

C. Class II Color Anodized Finish: AAMA 611 AA-M12C22A32, integrally colored anodic coating not less than 0.4 mil thick.

D. Pigmented Organic Coatings: AAMA 2603; polyester or acrylic baked enamel finish.

E. High Performance Organic Coatings: AAMA 2604; multiple-coat, thermally-cured fluoropolymer system.

PART 3 EXECUTION

3.01 PRIME WINDOW INSTALLATION

A. Install windows in accordance with manufacturer's instructions.

B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

C. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.

D. Install sill and sill end angles.

E. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

F. Install operating hardware not pre-installed by manufacturer.

END OF SECTION 08 51 13

SECTION 08 71 00
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for wood, aluminum, and hollow metal doors.

B. Hardware for fire-rated doors.

C. Electrically operated and controlled hardware.

D. This Section includes the furnishing of Door Hardware as shown on the Drawings and as specified herein including:
   1. Furnishing all required templates and schedules.
   2. Furnish hardware schedules and templates as required for fabrication of doors and frames under other Sections. Provide hardware that complies with applicable codes and requirements of authorities which have jurisdiction.

1.02 RELATED REQUIREMENTS

A. Section 08 11 13 - Hollow Metal Doors and Frames.

B. Section 08 14 16 - Flush Wood Doors.

C. Section 08 43 13 - Aluminum-Framed Storefronts: Door hardware, except as noted in section.

D. Section 28 10 00 - Access Control: Electronic access control devices.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

B. BHMA A156.1 - American National Standard for Butts and Hinges.

C. BHMA A156.3 - American National Standard for Exit Devices.

D. ITS (DIR) - Directory of Listed Products.

E. NFPA 70 - National Electrical Code.

F. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

G. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

H. UL (DIR) - Online Certifications Directory.

I. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

C. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; attendance is required by affected installers and the following:
   1. Architect.
   2. Installer's Architectural Hardware Consultant (AHC).
   3. Hardware Installer.
   4. Owner's Security Consultant.

D. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

E. Keying Requirements Meeting:
   1. Attendance Required:
   2. Agenda:
   3. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:

4. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, North Providence School Department, participants, and those affected by decisions made.
5. Deliver established keying requirements to manufacturers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
2. List groups and suffixes in proper sequence.
3. Provide complete description for each door listed.
4. Provide manufacturer's and product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
5. Include account of abbreviations and symbols used in schedule.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

F. Keying Schedule:
1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.

G. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in North Providence School Department's name and registered with manufacturer.

H. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum ten years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least five years of documented experience.

C. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion.
1. Closers: Five years, minimum.
2. Exit Devices: Three years, minimum.
3. Locksets and Cylinders: Three years, minimum.
4. Other Hardware: Two years, minimum.

1.09 KEYING AND KEY CONTROL

A. Extend existing keying sytem.

B. Grand Masterkey, Master Key and Construction Masterkey all locks and cylinders to a new 7-Pin Small Format Interchangeable Core System.

1.10 SPECIAL REQUIREMENTS

A. Hardware Supplier shall determine conditions and materials for all the doors and frames for proper application of hardware.

B. Hardware Supplier shall be responsible for the accuracy of the quantities, sizes, finish and proper hardware to be furnished, whether Specifically mentioned or not, and shall be responsible for determining all details, such as hand of doors, bevel of locks, etc.

C. Tools for Maintenance: All Special tools packed with hardware items shall be saved and turned over to the Owner upon completion of the work.

D. Lock fronts, flush bolt faces, and strikes shall be beveled in accordance with manufacturers' standards.

E. Lock fronts, flush bolt faces, and strikes shall be beveled in accordance with manufacturers' standards.

F. Handing shall be verified by this supplier.

G. Refer to Hollow Metal, Wood and Aluminum Door Sections regarding adequate blocking and reinforcing for surface-applied hardware.

H. Hardware not specifically listed for a particular opening shall be the same as hardware scheduled for similar openings.

I. All electrified hardware items are to be interfaced with the Fire Alarm System and/or Security System. After final approval of the hardware schedule, submit riser and wiring diagrams as required for the proper installation of complete electrical and electromechanical products. All Exterior Doors shall be equipped with DC (Door Position Switches) by Security Vendor. Low voltage power supplies are to be furnished with electrical/mechanical hardware.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. A. Hardware shall be entirely free from imperfection in manufacture and finish. Hardware shall be furnished as specified herein. Where only one manufacturer is listed, No substitution shall be permitted.

ITEM	MANUFACTURER
Locksets/Latchsets	(Sargent) Best, Schlage
Exit Devices	(Detex) Sargent, Von Duprin
Door Closers	(Dorma) Sargent, Norton
Door Pulls	(Rockwood), Don Jo, Burns
Protection Plates	(Rockwood), Don Jo, Burns
Floor & Wall Stops	(Rockwood), Don Jo, Burns
OH Stops & Stays	(Dorma), Rixson, ABH
Flush Bolts	(Door Controls Intl.), Hager, Rockwood
Thresholds	(National Guard Products), Zero, Pemko
Auto Door Bottoms	(National Guard Products), Zero, Pemko
Astragals	(National Guard Products), Zero, Pemko
Gasketing	(National Guard Products), Zero, Pemko
Butt Hinges	(Stanley) McKinney, PBB

B. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

C. Provide individual items of single type, of same model, and by same manufacturer.

D. Provide door hardware products that comply with the following requirements:
   1. Applicable provisions of federal, state, and local codes.
   2. Fire-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
   3. Hardware on Fire-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), testing firm acceptable to authorities having jurisdiction, or _____ as suitable for application indicated.
   4. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.

E. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.

2.02 HINGES

A. Hinges: Comply with BHMA A156.1, Grade 1.
   1. Provide hinges on every swinging door.
   2. Provide following quantity of butt hinges for each door:
      a. Doors up to 60 inches High: Two hinges.
      b. Doors From 60 inches High up to 90 inches High: Three hinges.
      c. Doors 90 inches High up to 120 inches High: Four hinges.
      d. Doors over 120 inches High: One additional hinge per each additional 30 inches in height.
   3. Hinges for interior doors shall be steel, Stanley CB Series, sized as follows:

DOOR THICKNESS	DOOR WIDTH	HINGE WEIGHT	HINGE HEIGHT
1-3/4"	Under 39"	Regular Weight	4-1/2"
1-3/4"	39" & over	Heavy Weight	5"

   4. Hinges for all Exterior Doors shall be Stanley CB1969R 5" x 4-1/2" x NRP x US32D Series (Pivot Reinforced).
   5. Hinges are to be of Three or Five knuckle concealed bearing design, equipped with full radial thrust and lateral bearing assemblies. The bearing assemblies are to be permanently lubricated and sealed. All hinges are to have positive non-rising pins and a hole in the bottom tip for easy pin removal. Pins shall be through-hardened. Hinges shall be guaranteed for the life of the building.
   6. Furnish Non-Removable Pins (NRP) at all interior locked doors that are reverse bevel.
   7. Conductor Hinges shall be Stanley “CB" Series x ACS1 1108 Modification x Mortar Guard.
   8. Swing Clear Hinges shall be Stanley CB1949 5” x 4-1/2"
   9. Note: for templating of pocket closers use center line of hinge pin.

2.03 FLUSH BOLTS

A. Flush Bolts shall be Door Controls International as follows:
   1. Manual Flush Bolts - 780F.
   2. Sett Latching Flush Bolts - 845/945.
   3. Automatic Flush Bolts - 842/942.

B. Furnish DCI 80 Dustproof Strikes for all Flush Bolts.

2.04 EXIT DEVICES

A. Unless noted otherwise, Exit Devices shall be Detex "Advantex" Series, in applications as noted in the HW Sets below.
   1. Acceptable Equals:
      a. Sargent 80.
      b. VonDuprin 98.

B. Lever trim shall match lockset trim.

C. Power Supplies shall be of the same manufacturer of Exit Devices to suit application. Interface with Access Control and/ Fire Alarm System, as required. Furnish Power Supplies for all Electrified Exit Devices.

D. Non-rated Mullions shall be Detex 90KR. Rated Mullions shall be Detex F90KR. Mullions shall key removable.

E. Electric Power Transfers shall be Detex PT-5.

F. Furnish cylinder dogging for all non fire rated exit devices.

G. Exit Devices: Comply with BHMA A156.3, Grade 1.
   1. Lever design to match lockset trim.
   2. Provide cylinder with cylinder dogging or locking trim.
   3. Provide exit devices properly sized for door width and height.
   4. Provide strike as recommended by manufacturer for application indicated.
   5. Provide UL (DIR) listed exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.

2.05 MORTISE LOCKS AND LATCHES

A. Unless noted otherwise, locksets and latchsets shall be heavy-duty mortise type, Sargent "8200" x “LNA" Lever and Rose Trim, in functions as noted in the Hardware Sets below.
   1. Acceptable Equals:
      a. Best 45H.
      b. Schlage L9000.

B. All locks shall be furnished with 2-3/4 in. backset and wrought box strikes.

C. Strike lips shall be detailed to provide clearance for latchbolt at door frames with projecting trim. At Pairs of Doors, strike lips shall be 7/8-in. to center.

D. Furnish Cylinders for all locking devices.

E. Provide Transformers for all Electrified Lockset applications.

2.06 PUSH PLATES

A. Push Plates shall be Rockwood 73F, stile permitting; otherwise, plates shall be Rockwood 73C.

2.07 DOOR PULLS AND PUSH BARS

A. Surface Pulls (straight) shall be Rockwood 112 Type 1HD Mounting, less Finish Washer. Countersink doors for screw heads — Push Plates shall cover thrubolt screws.

B. Offset Pulls shall be Rockwood BF158 x Type 12HD Mounting

C. Special Pulls shall be Rockwood RM3312 x full height x Type 12HD Mounting.

D. Push Bars shall be Rockwood 47 x full width x Type 12HD Mounting.

E. Flush Pulls shall be Rockwood 95A. Furnish Cylinder Pulls, Rockwood 80, if conflicts occur with Door Manufacturer.

2.08 CLOSERS

A. Overhead surface Closers shall be Dorma, non-sized, ADA approved, as follows:
   1. Exterior Doors: 8916-S-DST x BP89
   2. Interior Doors: 8900 x BP89 Series. Furnish "S-DS" feature where noted in the Hardware Sets.
   3. Sargent 350 and Norton 7500 are acceptable equals for Rack and Pinion Closers.
   4. Sargent 421 and Norton 2800ST are acceptable equals for Track Closers.

B. Unless specified otherwise, closers shall be mounted on that side of the opening least objectionable to the public view. Provide parallel arm type at reverse bevel conditions. Furnish drop plates and accessories as required.

C. Pocket Closers shall be Dorma TS9315-PKT-90.

D. All closers shall have full metal covers.

E. For all doors that can swing 180 degrees, template closers as equired (unless built-in stop is specified in the sets below).

2.09 ARMOR PLATES

A. Armor Plates shall be Rockwood A1062, 34-in. high. Width of plate shall be determined by the width of the door: plates shall be 2" LWOD on single doors, and 1" LWOD on pairs of doors.

2.10 KICK PLATES

A. Kick Plates shall be Rockwood K1062, 8-in. high, except as noted. Width of plate shall be determined by the width of the door: plates shall be 2" LWOD on single doors, and 1" LWOD on pairs of doors.

2.11 FLOOR STOPS

A. Floor Stops shall be provided where wall stops are not practical and where conditions allow. Floor Stops shall be equal to Rockwood 482.

B. Floor Stop & Holders shall be Rockwood 4915.

C. Where neither wall stops nor floor stops can be used, furnish an Overhead Stop equal to Dorma 900S Series.

2.12 WALL STOPS

A. A. Wall Stops shall be provided at 90-degree openings. Wall Stops shall be equal to Rockwood 405.

B. Where neither wall stops nor floor stops can be used, furnish an Overhead Stop equal to Dorma 900S Series.

2.13 THRESHOLDS

A. Unless otherwise detailed, Thresholds shall be as detailed for various configurations (Half Saddle, 8" wide etc).

B. Standard Exterior Thresholds shall be NGP 896S. Thresholds at Curbs shall be NGP 8135A.

C. All Thresholds shall be cut-in around mullions, frame members, stops, mullions (not butted up against) and shall provide a continuous surface across the full width of the opening from jamb to jamb. All Thresholds shall be properly sealed, grouted and/or caulked and set in a full bed of mastic.

2.14 WEATHERSTRIPPING, GASKETING AND DOOR BOTTOMS

A. Gasketing for exterior and interior doors shall be NGP 5020C, x full perimeter.

B. Door Bottoms shall be NGP 423/320 mortise type. If mortise type conflicts with material construction or other hardware, furnish NGP 520 surface type.

C. Where an Overlapping Astragal is specified (if not provided By Door Manufacturer), furnish NGP 139SP x SOSOC x full height of opening.

D. Where a Set of Astragals is specified, furnish NGP 600A (2 pieces) x full height of openings.

E. Door Sweeps shall be NGP 200SA.

F. Where "AG" appears in the door Schedule, furnish the following by Zero International.

1.	Full Perimeter Gasketing	770
2.	Door Bottom	360
3.	Set of Astragals (2 pieces)	328AA

2.15 MISCELLANEOUS

A. Silencers shall be furnished for all interior hollow metal/wood frames, three for each single door and two for each pair of doors. Silencers shall be Rockwood 608/609.

B. Magnetic Holders shall be Dorma EMF24120 Series x 24V (Power by Electrical).

C. Finger Guards shall be NGP 2248 A/2252C.

D. Catches shall be Ives CL21 A.

E. Coat Hooks shall be Rockwood RM806.

F. Furnish one (1) 3200-R Knox Box. Locate as directed.

G. Furnish one (1) Frame Set, Model PL2. To be turned over to the Owner at completion of project.

2.16 FINISHES

A. Unless noted otherwise, finish of hardware shall be as follows:
   1. Butts (interior), Cylinders, Floor Stops, Flush Bolts, shall be satin chrome finish (626/US26D).
   2. Butts (exterior), Locksets and Latchsets, Exit Devices, Door Pulls, Protection Plates, etc. shall be satin stainless steel (630/US32D). Plates shall be B.S. .062 ga.
   3. Special Pulls shall be 316 Stainless Steel.
   4. Thresholds and Surface Door Bottoms shall be Aluminum.
   5. Closers shall be sprayed to match other hardware.
   6. Gasketing shall be Charcoal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

B. Verify that electric power is available to power operated devices and of correct characteristics.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.

C. Use templates provided by hardware item manufacturer.

D. Do not install surface mounted items until application of finishes to substrate are fully completed.

E. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
   1. Mounting heights in compliance with ADA Standards:
      a. Locksets: 40 inch.
      b. Exit Devices: 40 inch.
      c. Push Plates/Pull Bars: 42 inch.

F. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

G. Hinges: Position top hinge five inches below head, bottom hinge ten inches above finished floor and intermediate hinge equally spaced between top and bottom hinges.

H. Overhead Closers:
   1. Verify each head condition prior to furnishing door closers.
   2. Surface-mounted on Door: Surface shoe application for standard operation and solf it plate application for parallel arms. Provide Special shoe plates and brackets where Specified or where required by job conditions.
   3. Set hardware plumb, level and in exact alignment and location. Conceal and countersink fasteners wherever possible.

3.03 ADJUSTING

A. Adjust work under provisions of Section 01 70 00 - Execution and Closeout Requirements.

B. Adjust hardware for smooth operation.

C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.04 CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

B. Clean adjacent surfaces soiled by hardware installation.

C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

D. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

3.05 PROTECTION

A. Protect finished Work under provisions of Section 01 70 00 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

3.06 COMPLETION AND CONTINUED MAINTENANCE

A. Before completion of work of this Section, inspect work with Architect and adjust and correct work to leave operating parts in perfect operating condition, jointing to adjacent material tight, surfaces without blemishes or stains, work properly executed and complete, and defects and damaged work replaced or corrected.

3.07 HARDWARE SETS

A. Each Hardware Set listed below represents the hardware requirements for one opening (single door or pair of doors). Provide the quantities required of each set for the work. Provide all accessories required to ensure functionality of each item and to ensure functionality of complete hardware set.

B. The numbers used opposite locksets to identify the function are Sargent numbers. Where "TO" is indicated on locksets, outside lever shall be furnished with a tactile surface on inside face.

C. Security items are listed below the individual Hardware Sets for Hardware Set coordination and templating for doors and frames. The references in the Hardware Sets are for advisory purposes. See Security Drawings for actual requirements.

D. Hardware Sets: Hardware Schedule is included on the following pages.

HARDWARE SCHEDULE

HARDWARE SET 1: EXTERIOR, DOUBLE DOOR, ALUMINUM
DOORS: 109

6	**PIVOT REINFORCED HINGES**	
2	**EXIT DEVICE**	**10-01-CD-EXXW**
2	**POWER TRANSFER**	
1	**POWER SUPPLY**	
2	**CLOSER**	
1	**KEYED REMOVABLE MULLION**	
1	**RAIN DRIP EDGE**	
1	**THRESHOLD**	**X FULL WIDTH**
1	**GASKETING**	
2	**SWEEP**	

FINAL CYLINDERS AND KEYS
CONSTRUCTION CORES AND KEYS
2 (DOOR CONTACTORS BY OTHERS)
ACCESS CONTROL DEVICE BY OTHERS

HARDWARE SET 2: EXTERIOR, DOUBLE DOOR, HOLLOW METAL
DOORS: ST00

6	**HINGES**	
2	**EXIT DEVICE**	**10-01-CD-CD-EXXW**
2	**CLOSER**	
1	**KEYED REMOVABLE MULLION**	
1	**RAIN DRIP EDGE**	
1	**THRESHOLD**	**X FULL WIDTH**
1	**GASKETING**	
2	**SWEEP**	

FINAL CYLINDERS AND KEYS
CONSTRUCTION CORES AND KEYS
2 (DOOR CONTACTORS BY OTHERS)

HARDWARE SET 3: INTERIOR, SINGLE DOOR, WOOD
DOORS: ST01

3	**HINGES**	
1	**EXIT DEVICE**	**F-10-09D-EU-FSA-EX (FAIL SAFE)**
1	**CLOSER**	
1	**KICK PLATE**	
1	**WALL STOP**	

1 GASKETING
FINAL CYLINDERS AND KEYS
CONSTRUCTION CORES AND KEYS

HARDWARE SET 4: INTERIOR, DOUBLE DOOR, WOOD
DOORS: ST02,

6	**HINGES**	
2	**EXIT DEVICE**	**F-20-09DEU-FSA-ES (FAIL SAFE)**
2	**CLOSER**	
2	**KICK PLATE**	
2	**WALL STOP**	
1	**GASKETING**	

HARDWARE SET 5: INTERIOR, SINGLE DOOR, WOOD
DOORS: 101, 102, 105, 107, 201, 202, 205, 207

3	**HINGES**	
1	**LOCKSET**	**16 (VESTIBULE)**
1	**CLOSER**	
1	**KICK PLATE**	
1	**WALL STOP**	
1	**GASKETING SET**	**ZERO 770**
1	**AUTO DOOR BOTTOM**	**ZERO 360**

HARDWARE SET 6: INTERIOR, SINGLE DOOR, WOOD

DOORS: 104, 106, 206, 208

3	**HINGES**	
1	**LOCKSET**	**56 (OFFICE)**
1	**CLOSER**	
1	**KICK PLATE**	
1	**WALL STOP**	
1	**GASKETING SET**	**ZERO 770**
1	**AUTO DOOR BOTTOM**	**ZERO 360**

HARDWARE SET 7: INTERIOR, SINGLE DOOR, WOOD

DOORS: 101.2, 107.1, 201.2, ,207.2

3	**HINGES**	
1	**LATCHSET**	**15 (PASSAGE)**
1	**WALL STOP**	
1	**GASKETING SET**	**ZERO 770**
1	**AUTO DOOR BOTTOM**	**ZERO 360**

HARDWARE SET 8: INTERIOR, SINGLE DOOR, WOOD

DOORS: T3, T6

3	**HINGES**	
1	**PRIVACY LATCHSET**	**49-65 (PRIVACY INDICATOR)**
1	**CLOSER**	
1	**WALL STOP**	
1	**GASKETING SET**	**ZERO 770**
1	**AUTO DOOR BOTTOM**	**ZERO 360**

HARDWARE SET 9: INTERIOR, SINGLE DOOR, WOOD

DOORS: 103, 203

3	HINGES	
1	LOCKSET	04 (STOREROOM)
1	CLOSER	
1	KICK PLATE	
1	WALL STOP	
1	GASKETING SET	ZERO 770
1	AUTO DOOR BOTTOM	ZERO 360

HARDWARE SET 10: INTERIOR, SINGLE DOOR, WOOD

DOORS: T1, T2, T4, T5

3	HINGES	
1	PUSH PLATE	
1	PULL	
1	CLOSER	
1	KICK PLATE	
1	WALL STOP	
1	GASKETING	

HARDWARE SET 11: INTERIOR, DOUBLE DOOR, WOOD

DOORS: 100A, 200A

6	HINGES	
2	EXIT DEVICE	F20-09-D-EU-FSA-EX
2	HOLD OPENS	
1	GASKETING	
2	SWEEP	
	FINAL CYLINDERS AND KEYS	
	CONSTRUCTION CORES AND KEYS	

END OF SECTION 08 71 00

SECTION 08 80 00

GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.

B. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealants for other than glazing purposes.

B. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

C. Section 08 14 16 - Flush Wood Doors: Glazed lites in doors.

D. Section 08 43 13 - Aluminum-Framed Storefronts: Glazing furnished as part of storefront assembly.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.

F. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass.

G. ASTM C1193 - Standard Guide for Use of Joint Sealants.

H. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.

I. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings.

J. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.

K. GANA (SM) - GANA Sealant Manual.

L. NFRC 100 - Procedure for Determining Fenestration Product U-factors.

M. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

N. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data on Insulating Glass Unit and Plastic Film Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

D. Samples: Submit two samples 12 by 12 inch in size of glass units.

E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in North Providence School Department's name and registered with manufacturer.

F. Maintenance Materials: Furnish the following for North Providence School Department's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Insulating Glass Units: One of each glass size and each glass type.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years documented experience.

1.07 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

C. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glass Fabricators:
   1. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com.
   2. Viracon, Inc: www.viracon.com/#sle.
   3. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Float Glass Manufacturers:
   1. Cardinal Glass Industries: www.cardinalcorp.com.
   2. Guardian Glass, LLC: www.guardianglass.com.
   3. Substitutions: Refer to Section 01 60 00 - Product Requirements.

C. Laminated Glass Manufacturers:
   1. Cardinal Glass Industries: www.cardinalcorp.com.
   2. Viracon, Architectural Glass segment of Apogee Enterprises, Inc: www.viracon.com.
   3. Substitutions: Refer to Section 01 60 00 - Product Requirements.

D. Plastic Films Manufacturers:
   1. 3M Window Film: www.3m.com.
   2. Flexvue Films: www.flexvuefilms.com.
   3. Llumar, an Eastman Chemical Company.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   2. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
   3. Glass thicknesses listed are minimum.

B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
   1. In conjunction with vapor retarder and joint sealer materials described in other sections.

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
   1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless noted otherwise.
   1. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and FT.
   2. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
   3. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
   1. Laminated Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 test requirements for Category II.
   2. Polyvinyl Butyral (PVB) Interlayer: 0.060 inch thick, minimum.

2.04 INSULATING GLASS UNITS

A. Manufacturers:
   1. Any of the manufacturers specified for float glass.
   2. Fabricator certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.

B. Insulating Glass Units: Types as indicated.
   1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
   3. Spacer Color: Black.
   4. Edge Seal:
      a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
   5. Color: Black.
   6. Purge interpane space with dry air, hermetically sealed.

C. Type G1 - Insulating Glass Units: Vision glass, triple glazed.
   1. Applications: Exterior glazing as indicated on drawings.
   2. Space between lites filled with argon.
   3. Outboard Lite: Heat-strengthened float glass, 1/4 inch thick, minimum.
      a. Tint: Clear.
      b. Vitro Solarban 60
      c. Coating: Low-E (solar control type), on #2 surface.
   4. Inboard Lite 1 of 2: Fully tempered float glass, 1/4 inch thick, minimum.
      a. Tint: Clear.
   5. Film: See 2.05 Plastic Films
   6. Inboard Lite 2 of 2: Fully tempered float glass, 1/4 inch thick, minimum.
      a. Tint: Clear.
   7. Total Thickness: 1.259" inch.
   8. Thermal Transmittance (U-Value):.24, maximum.

9. Visible Light Transmittance (VLT): 67% percent, minimum.
10. Shading Coefficient:.44, nominal.
11. Solar Heat Gain Coefficient (SHGC):.38, maximum.
12. Visible Light Reflectance, Outside: 11 percent, nominal.
13. Glazing Method: Dry glazing method, gasket glazing.

D. Type G2 - Insulating Glass Units: Vision glass, double glazed.
1. Applications: Exterior Doors.
2. Space between lites filled with air.
3. Outboard Lite: Heat-strengthened float glass, 1/4 inch thick, minimum.
a. Tint: Clear.
b. Coating: Low-E (passive type), on #2 surface.
4. Inboard Lite: Heat-strengthened float glass, 1/4 inch thick, minimum.
a. Tint: Clear.
5. Total Thickness: 1 inch.

E. Type G3 - Vision glazing: Vision glass, single glazed.
1. Applications: Interior door and sidelite glazing.
2. Lite: Fully tempered float glass, 1/4 inch thick.
a. Tint: Clear.

2.05 PLASTIC FILMS

A. Safety and Security Polyvinyl Butyral (PVB) Interlayer for Laminated Glazing: Computer-based digital imaging system provided on PVB interlayer for placement within laminated glazing.
1. Application: Storefront window assemblies between inboard layers.
2. Glass Type: Laminated safety glazing.
3. Basis of Design: .090" Sentryglas

2.06 GLAZING COMPOUNDS

A. Type GC-2 - Butyl Sealant: Single component; ASTM C920, Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.

2.07 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
1. Width: As required for application.
2. Thickness: As required for application.
3. Spacer Rod Diameter: As required for application.

D. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

E. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that the minimum required face and edge clearances are being provided.

C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

D. Verify that sealing between joints of glass framing members has been completed effectively.

E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 INSTALLATION - DRY GLAZING METHOD (TAPE AND GASKET SPLINE GLAZING)

A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.

B. Cut glazing tape to length; install on glazing pane. Seal corners by butting tape and sealing junctions with butyl sealant.

C. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

D. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.

E. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.

F. Carefully trim protruding tape with knife.

3.06 INSTALLATION - PLASTIC FILM, FIELD APPLIED TO EXTERIOR STOREFRONT DOOR

A. Install plastic film with adhesive, applied in accordance with film manufacturer's instructions.

B. Place without air bubbles, creases or visible distortion.

C. Install film tight to perimeter of glass and carefully trim film with razor sharp knife. Provide 1/16 inch to 1/8 inch gap at perimeter of glazed panel unless otherwise required. Do not score the glass.

3.07 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

C. Monitor and report installation procedures and unacceptable conditions.

3.08 CLEANING

A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

B. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

C. Remove non-permanent labels immediately after glazing installation is complete.

D. Clean glass and adjacent surfaces after sealants are fully cured.

E. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.09 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION 08 80 00

SECTION 08 91 00

LOUVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Louvers, frames, and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 62 00 - Sheet Metal Flashing and Trim.

B. Section 07 90 05 - Joint Sealers.

C. Section 23 31 00 - HVAC Ducts and Casings: Ductwork attachment to louvers, and blank-off panels.

D. Section 23 3300 - Air Duct Accessories: dampers associated with exterior wall louvers.

E. Section - Direct-Digital Control System for HVAC: Actuators for operable louvers.

F. Section - Instrumentation and Control Devices for HVAC: Actuators for operable louvers.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.

B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

C. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

D. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating.

E. AMCA 511 - Certified Ratings Program for Air Control Devices.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

G. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

H. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

I. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

J. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

K. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

C. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

D. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, tolerances; head, jamb and sill details; blade configuration, screens, blankout areas required, and frames.

E. Samples: Submit two samples 4x4 inches in size illustrating finish and color of exterior and interior surfaces.

F. Test Reports: Independent agency reports showing compliance with specified performance criteria.

G. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

H. Maintenance Data: Include lubrication schedules, and adjustment requirements .

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum ten years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.

1.06 PROJECT CONDITIONS

A. Coordinate work of this section with installation of metal siding and masonary flashings.

B. Coordinate work of this section with installation of mechanical ductwork and electrical services to motorized devices.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide twenty year manufacturer warranty against distortion, metal degradation, and failure of connections.
   1. Finish: Include coverage against degradation of exterior finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wall Louvers:
   1. Ruskin. www.ruskin.com.
   2. Airolite Company, LLC: www.airolite.com.
   3. Greenheck. www.greenheck.com
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 LOUVERS

A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified under AMCA 511.
   1. Wind Load Resistance: Design to resist positive and negative wind load as required by IBC 2015 code without damage or permanent deformation.
   2. Intake Louvers: Design to allow maximum of 0.01 oz/sq ft water penetration at calculated intake design velocity based on design air flow and actual free area, when tested in accordance with AMCA 500-L.
   3. Screens: Provide insect screens at intake louvers and bird screens at exhaust louvers.

B. Stationary Louvers : Horizontal blade, formed galvanized steel sheet construction, with intermediate mullions matching frame.
   1. Free Area: 50 percent, minimum.
   2. Static Pressure Loss:.05 inch wg maximum per square foot of free area at velocity of 500 fpm, when tested in accordance with AMCA 500-L.
   3. Blades: Zig-zag, sight-proof.
   4. Frame: Depth based of wall thickness, ; corner joints , with continuous recessed caulking channel each side.
   5. Metal Thickness: Frame 0.125 inch; blades 0.125 inch.
   6. Finish: KYNAR 500 custom color or Architect approved equal.
   7. Screens: Provide insect screens at intake louvers and bird screens at exhaust louvers.
   8. Mounting: Flange and channel based on wall and/or soffit conditions.

2.03 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T5 temper,.

1. Color Anodizing: AAMA 611 Class I, AA-M12C22A42/44.

B. Bird Screen: Interwoven wire mesh of aluminum, 0.063 inch diameter wire, 1/2 inch open weave, diagonal or square design.

C. Insect Screen: 18 x 16 size aluminum mesh.

2.04 FINISHES

A. Superior Performing Organic Coatings System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch.

2.05 ACCESSORIES

A. Blank-Off Panels: Aluminum face and back sheets, polyisocyanurate foam core, 1-1/2 inch thick, painted black on exterior side; provide where duct connected to louver is smaller than louver frame, sealing off louver area outside duct.

B. Screens: Frame of same material as louver, with reinforced; mitered and welded corners; removable, with clip fasteners, and installed on inside face of louver frame.

C. Fasteners and Anchors: Stainless steel.

D. Flashings: Of same material as louver frame, sheet aluminum formed or extruded to required shape, single length in one piece per location.

E. Head and Sill Flashings: See Section 07 62 00.

F. Sealant: type, as specified in Section .

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared openings and flashings are ready to receive work and opening dimensions are as indicated on shop drawings; or instructed by the manufacturer.

B. Verify that field measurements are as indicated on shop drawings; or instructed by the manufacturer.

3.02 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.

B. Install louvers level and plumb.

C. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

D. Secure louver frames in openings with concealed fasteners.

E. Install perimeter sealant and backing rod in accordance with Section 07 90 05.

3.03 CLEANING

A. Strip protective finish coverings.

B. Clean surfaces and components.

END OF SECTION 08 91 00

SECTION 09 05 61

COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
   1. Resilient tile.
   2. Thin-set ceramic tile.

B. Preparation of new and existing concrete floor slabs for installation of floor coverings.

C. Testing of concrete floor slabs for moisture and alkalinity (pH).

D. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
   1. Owners Project Manager shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Owners Project Manager's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.

E. Patching compound.

F. Remedial floor coatings.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Moisture emission reducing curing and sealing compound for slabs to receive adhered flooring, to prevent moisture content-related flooring failures; to remain in place, not to be removed.

1.03 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens).

B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete.

C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

E. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.05 SUBMITTALS

A. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
   1. Moisture and alkalinity (pH) limits and test methods.
   2. Manufacturer's required bond/compatibility test procedure.

B. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.

C. Testing Agency's Report:
   1. Description of areas tested; include floor plans and photographs if helpful.
   2. Summary of conditions encountered.
   3. Moisture and alkalinity (pH) test reports.
   4. Copies of specified test methods.
   5. Recommendations for remediation of unsatisfactory surfaces.

6. Product data for recommended remedial coating.
7. Submit report to Architect.
8. Submit report not more than two business days after conclusion of testing.

D. Adhesive Bond and Compatibility Test Report.

E. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

1.06 QUALITY ASSURANCE

A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Owners Project Manager.

B. Owners Project Manager's Responsibility Relating to Independent Agency Testing:
1. Provide access for and cooperate with testing agency.
2. Confirm date of start of testing at least 10 days prior to actual start.
3. Allow at least 4 business days on site for testing agency activities.
4. Achieve and maintain specified ambient conditions.
5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer’s instructions and recommendations.

B. Deliver materials in manufacturer’s packaging; include installation instructions.

C. Keep materials from freezing.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.

B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.01 MATERIALS

A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
2. Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
3. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.

B. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
1. Thickness: As required for application and in accordance with manufacturer's installation instructions.
2. Use product recommended by testing agency and flooring system manufacturer.
3. Products: Subject to compliance with flooring manufacturer's requirements, the following products may be provided.
   a. Allied Construction Technologies, Inc; AC Tech 2170: www.actechperforms.com/#sle.
   b. ARDEX Engineered Cements; ARDEX MC RAPID: www.ardexamericas.com/#sle.

c. Crown Polymers, a division of American Polymers Corporation; CrownShield 8303 MVB: www.crownpolymers.com/#sle.
d. Custom Building Products; TechMVC Moisture Vapor and Alkalinity Barrier: www.custombuildingproducts.com/#sle.
e. H.B. Fuller Construction Products, Inc; TEC LiquiDam with TEC Level Set 200 SLU: www.tecspecialty.com/#sle.
f. LATICRETE International, Inc; LATICRETE NXT Vapor Reduction Coating with LATICRETE NXT Level Plus: www.laticrete.com/#sle.
g. Maxxon Corporation; Aquafin SG2: www.maxxon.com/#sle.
h. Sika Corporation; Sikafloor Moisture Tolerance Epoxy Primer and Sikafloor Self-Leveling Moisture Tolerant Resurfacer: www.sikafloorusa.com/#sle.
i. Tnemec Company, Inc; Series 208 Epoxoprime MVT: www.tnemec.com/#sle.
j. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

A. Perform following operations in the order indicated:
1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
b. Removal of existing floor covering.
2. Preliminary cleaning.
3. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
4. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
5. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
6. Specified remediation, if required.
7. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.
8. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.
9. Other preparation specified.
10. Adhesive bond and compatibility test.
11. Protection.

B. Remediations:
1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.02 REMOVAL OF EXISTING FLOOR COVERINGS

A. Comply with local, State, and federal regulations and recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.

B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

3.03 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.

B. Do not use solvents or other chemicals for cleaning.

3.04 MOISTURE VAPOR EMISSION TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F1869 and as follows.

D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.

F. Report: Report the information required by the test method.

3.05 INTERNAL RELATIVE HUMIDITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F2170 Procedure A and as follows.

D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.

F. Report: Report the information required by the test method.

3.06 ALKALINITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.07 PREPARATION

A. See individual floor covering section(s) for additional requirements.

B. Comply with requirements and recommendations of floor covering manufacturer.

C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.

D. Do not fill expansion joints, isolation joints, or other moving joints.

3.08 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

3.09 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with requirements and recommendations of coating manufacturer.

END OF SECTION 09 05 61

SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal stud wall, ceiling and soffit framing.

B. Metal framing for top of wall bracing and ceiling framing.

C. Resilient sound isolation clips.

D. Acoustic insulation.

E. Gypsum sheathing.

F. Cementitious backing board.

G. Gypsum wallboard.

H. Cementitious backer board.

I. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 01 78 39 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

C. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

D. Section 07 90 05 - Joint Sealers: Acoustic sealant.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

B. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute. (replaced SG-971)

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

D. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.

E. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

F. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board.

G. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.

H. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

I. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

J. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.

K. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

L. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

M. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base.

N. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

O. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing.

P. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units.

Q. ASTM C1396/C1396M - Standard Specification for Gypsum Board.

R. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.

S. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

T. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

U. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

V. ASTM E413 - Classification for Rating Sound Insulation.

W. GA-214 - Recommended Levels of Gypsum Board Finish; Gypsum Association.

X. GA-216 - Application and Finishing of Gypsum Panel Products.

Y. GA-226 - Application of Gypsum Board to Form Curved Surfaces; Gypsum Association.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate special details associated with vertical deflection joints and acoustic seals. Provide special details for suspended ceilings. Indicate layout, anchorage to structure, type and location of fasteners, framed openings, accessories, and items of related work.

C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.05 QUALITY ASSURANCE

A. Perform in accordance with ASTM C 840. Comply with requirements of GA-600 for fire-rated assemblies.

B. Installer Qualifications: Company specializing in performing gypsum board application and finishing, with minimum five years of documented experience.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire rated assemblies as indicated on drawings.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies per drawings.

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com/#sle.
   2. Dietrich Metal Framing: www.dietrichindustries.com.
   3. Marino: www.marinoware.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/360 at 5 psf.
   1. Exception: The minimum metal thickness and section properties requirements of ASTM C 645 are waived provided steel of 40 ksi minimum yield strength is used, the metal is continuously dimpled, the effective thickness is at least twice the base metal thickness,

and maximum stud heights are determined by testing in accordance with ASTM E 72 using assemblies specified by ASTM C 754.
    a. Acceptable Products:
        1) Dietrich Metal Framing; UltraSteel (tm): www.dietrichindustries.com.
        2) Clark Western Building Systems; UltraSteel (tm): www.clarkwestern.com.
2. Studs: "C" shaped with flat or formed webs with knurled faces.
3. Runners: U shaped, sized to match studs.
4. Ceiling Channels: C shaped.
5. Furring: Hat-shaped sections, minimum depth of 7/8 inch.
6. Resilient Furring Channels: 1/2 inch depth, for attachment to substrate through one leg only.
    a. Products:
        1) Same manufacturer as other framing materials.
7. Resilient Sound Isolation Clips: Steel resilient clips with molded rubber isolators, attaches to framing; improves noise isolation performance of wall and floor-ceiling assemblies.

C. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.

D. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

E. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot dipped galvanized coating.
3. Provide kickers / framing for top of wall and soffits as necessary.

F. Non-structural Framing Accessories:
1. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
    a. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.
    b. Products:
        1) ClarkDietrich; Pony Wall (PW): www.clarkdietrich.com/#sle.
        2) Substitutions: See Section 01 60 00 - Product Requirements.
2. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.
    a. Products:
        1) ClarkDietrich; FastBridge Clip (FB33): www.clarkdietrich.com/#sle.
        2) Substitutions: See Section 01 60 00 - Product Requirements.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
1. CertainTeed Corporation: www.certainteed.com/#sle.
2. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
3. National Gypsum Company: www.nationalgypsum.com/#sle.
4. USG Corporation: www.usg.com/#sle.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Impact-Rated Wallboard: Tested to Level 3 soft-body and hard-body impact in accordance with ASTM C1629.
1. Application: Walls.
2. Paper-Faced Type: Gypsum wallboard as defined in ASTM C1396/C1396M.
3. Type: Fire resistance rated Type X, UL or WH listed.

4. Thickness: 5/8 inch.
5. Edges: Tapered.
6. Products:
    a. National Gypsum Company; Gold Bond Hi-Impact Brand XP Wallboard.
    b. USG Corporation; Fiberock Brand Panels--VHI Abuse-Resistant.

C. Backing Board For Wet Areas: One of the following products:
1. Application: Surfaces behind tile in wet areas.
2. Application: Horizontal surfaces behind tile in wet areas including countertops.
3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9-SystemDeleted or ASTM C1325.
    a. Thickness: 1/2 inch.
    b. Products:
        1) Custom Building Products; Wonderboard.
        2) National Gypsum Company; PermaBase Brand Cement Board.
        3) USG Corporation: www.usg.com/#sle.
        4) Substitutions: See Section 01 60 00 - Product Requirements.

D. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings, unless otherwise indicated.
2. Thickness: 1/2 inch.
3. Edges: Tapered.

E. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
1. Application: Exterior sheathing, unless otherwise indicated.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Glass-Mat-Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
4. Core Type: Type X.
5. Type X Thickness: 5/8 inch.
6. Edges: Square, for vertical application.
7. Glass-Mat-Faced Products:
    a. CertainTeed Corporation; GlasRoc Brand.
    b. Georgia-Pacific Gypsum; DensGlass Sheathing.
    c. National Gypsum Company; Gold Bond Brand e2XP Extended Exposure Sheathing.
    d. Temple-Inland Inc; GreenGlass Exterior Sheathing.
    e. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 ACCESSORIES

A. Acoustic Insulation: ASTM C 665; preformed glass fiber, friction fit type, unfaced. Thickness to fit cavity. As specified in Section 07 21 00.

B. Sound Isolation Tape: Elastomeric foam tape for sound decoupling.
1. Surface Burning Characteristics: Provide assemblies with flame spread index of 75 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
2. Tape Thickness: 1/4 inch.

C. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

D. Water-Resistive Barrier: As specified in Section 07 25 00.

E. Finishing Accessories: ASTM C1047, rigid plastic, unless otherwise indicated.
1. Types: As detailed or required for finished appearance.
2. Special Shapes: In addition to conventional cornerbead and control joints, provide U-bead at exposed panel edges.

F. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.

G. Joint Materials: ASTM C475 and as recommended by gypsum board manufacturer for project conditions.
   1. Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
   2. Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
   3. Ready-mixed vinyl-based joint compound.
   4. Powder-type vinyl-based joint compound.
   5. Chemical hardening type compound.

H. Screws for Attachment to Steel Members Less Than 0.03 inch In Thickness, to Wood Members, and to Gypsum Board: ASTM C1002; self-piercing tapping type; cadmium-plated for exterior locations.

I. Screws for Attachment to Steel Members From 0.033 to 0.112 Inch in Thickness: ASTM C954; steel drill screws for application of gypsum board to loadbearing steel studs.

J. Screws: ASTM C 1002; self-piercing tapping type; cadmium-plated for exterior locations.

K. Staples: ASTM C 840.

L. Anchorage to Substrate: Tie wire, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
   1. Level ceiling system to a tolerance of 1/600.
   2. Laterally brace entire suspension system, to structure above.
   3. Install bracing as required at exterior locations to resist wind uplift.

C. Studs: Space studs as indicated.
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling framing in accordance with details.
   3. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.
   4. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Connections: Minimum (4) #12 screws per connection of cold formed metal framing members.

F. Standard Wall Furring: Install at concrete and masonry walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
   1. Orientation: Horizontal; or Vertical.
   2. Spacing: At 16 inches on center; or As permitted by standard.

G. Blocking: Install wood blocking for support of:

1. Framed openings.
2. Wall-mounted cabinets.
3. Plumbing fixtures.
4. Toilet partitions.
5. Toilet accessories.
6. Wall-mounted door hardware.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Sound Isolation Tape: Apply to vertical studs and top and bottom tracks/runners in accordance with manufacturer's instructions.

C. Acoustic Sealant: Install as follows:
   1. Place two beads continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum board.
   3. In non-fire-rated construction, seal around all penetrations by conduit, pipe, ducts, and rough-in boxes; and other penetrations.

3.04 BOARD INSTALLATION

A. Comply with ASTM C 840 and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
   1. Exception: Tapered edges to receive joint treatment at right angles to framing.

C. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
   1. Seal joints, cut edges, and holes with water-resistant sealant.

D. Exterior Soffits: Install exterior soffit board perpendicular to framing, with staggered end joints over framing members or other solid backing.
   1. Seal joints, cut edges, and holes with water-resistant sealant.

E. Cementitious Backing Board: Install over steel framing members where indicated, in accordance with ANSI A108.11-SystemDeleted and manufacturer's instructions.

F. Installation on Metal Framing: Use screws for attachment of all gypsum board except face layer of non-rated double-layer assemblies, which may be installed by means of adhesive lamination.

G. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as directed.
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated.

3.06 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.

B. Paper Faced Gypsum Board: Use fiberglass joint tape, bedded with ready-mixed vinyl-based; or powder-type vinyl-based; or chemical hardening type joint compound and finished with ready-mixed vinyl-based; or powder-type vinyl-based; or chemical hardening type joint compound.

C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.

2. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish or where FRP panel to be installed.
3. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.

D. Finish gypsum board in scheduled areas in accordance with levels defined in GA-214; or ASTM C 840 and as scheduled below.
1. Above Finished Ceilings Concealed From View: Level 1.
2. Utility Areas and Areas Behind Cabinetry: Level 2.
3. Walls and Ceilings to Receive Flat Paint Finish: Level 4.

E. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
1. Feather coats of joint compound so that camber is maximum 1/32 inch.
2. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
3. Taping, filling and sanding is not required at base layer of double layer applications.

3.07 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.08 FINISH LEVEL SCHEDULE (SEE 1.03 REFERENCES FOR DEFIINITION)

A. Level 1: Above finished ceilings concealed from view.

B. Level 2: Utility areas and areas behind cabinetry or where FRP will be applied.

C. Level 4: Walls and ceilings scheduled to receive flat paint finish.

END OF SECTION 09 21 16

SECTION 09 30 00

TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Cementitious backer board as tile substrate.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 07 90 05 - Joint Sealers.

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium).
   1. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar.
   2. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar.
   3. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement.
   4. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive.
   5. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
   6. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy.
   7. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout.
   8. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout.
   9. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework.
   10. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units.
   11. ANSI A108.11-SystemDeleted - American National Standard for Interior Installation of Cementitious Backer Units.
   12. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar.
   13. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone.
   14. ANSI A118.1 - American National Standard Specifications for Dry-Set Cement Mortar.
   15. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar.
   16. ANSI A118.5 - American National Standard Specifications for Chemical Resistant Furan Mortars and Grouts for Tile Installation.
   17. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation.
   18. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation.

19. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units.
20. ANSI A118.9-SystemDeleted - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units.
21. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation.

B. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar.

C. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

C. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

D. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

E. Samples: Mount tile and apply grout on two plywood panels, minimum 18 x 18 inches in size illustrating pattern, color variations, and grout joint size variations.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.05 QUALITY ASSURANCE

A. Maintain one copy of The Tile Council of North America Handbook and ANSI A108 Series/A118 Series on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum 10 years of documented experience.

C. Installer Qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience.

1.06 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect materials from freezing or overheating in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

1.09 EXTRA MATERIALS

A. Provide 2 percent of each size, color, and surface finish of tile specified.

PART 2 PRODUCTS

2.01 TILE

A. Manufacturers: All products by the same manufacturer.
1. American Olean Corporation: www.americanolean.com.
2. Dal-Tile Corporation: www.daltile.com.
3. United States Ceramic Tile.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Basis-of-Design Product: The design for each tile type is based on the product named. Subject to compliance with requirements, provide either the named product or an equal product by one of the other manufacturers specified.

C. Ceramic Mosaic Floor Tile:
   1. Composition: Porcelain.
   2. Surface: Slip-resistant, with abrasive admixture
   3. Size and Shape: 2 x 2 inch.
   4. Nominal Thickness: 1/4 inch.
   5. surface Finish: Unglazed.
   6. Face: Plain with cushion edges.
   7. Basis-of-Design Product: Dal-Tile Corporation, Keystone Unglazed Mosaic Tile, or equal by approved manufacturer.
   8. Color/Pattern: A multi-colored custom random pattern shall be provided as selected by Architect from full range of solid colors utilizing up to five different colored tiles in each room from full range in United States Ceramic Tile price groups 1 through 3, or equal. Pattern to include 75% group 1 and 2 and 25% group 3, or equivalent vibrant color group or equal product.

D. Ceramic Wall Tile :
   1. Composition: Porcelain.
   2. Size and Shape: 3 x 6 inch..
   3. Thickness: 1/4 inch.
   4. surface Finish: Glazed, semi-gloss/brite or matte, opaque.
   5. Face: Plain with cushioned edges.
   6. Basis-of-Design Product: United States Ceramic Tile, Color collection, or equal by approved manufacturer. Vibrant colors are required.
   7. Color/Pattern: A multi-colored custom random pattern shall be provided as selected by Architect from full range of solid colors utilizing up to five different colored tiles in each room from full range in United States Ceramic Tile price groups 1 through 3, or equal. Pattern to include 75% group 1 and 2 and 25% group 3, or equivalent vibrant color group or equal product.

2.02 TRIM AND ACCESSORIES

A. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
   1. Applications:
      a. Open Edges: Bullnose.
      b. Inside Corners: Jointed.
      c. Floor to Wall Joints: Cove base.
   2. Manufacturers: Same as for tile.

B. Non-Ceramic Trim: Brushed stainless steel, style and dimensions to suit application, as indicated on drawings for setting using tile mortar or adhesive.
   1. Applications: Use in the following locations:
      a. Open edges of wall tile.
      b. Open edges of floor tile.
      c. Transition between floor finishes of different heights.
      d. Expansion and control joints, floor and wall.
      e. Floor to wall joints.
   2. Manufacturer:
      a. Schluter-Systems: www.schluter.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Thresholds: 2 inches wide by full width of wall or frame opening; beveled edge on both long edges; without holes, cracks, or open seams.
   1. Thickness: 1/2 inch.

2. Material: Marble, honed finish.

2.03 WATERPROOFING AND CRACK-SUPPRSSION MEMBRANE FOR THIN-SET TILE INSTALLATIONS

A. General: Manufacturer's standard product that complies with ANSI A118.10.

B. Fabric-Reinforced, Fluid-Applied Product: System consisting of liquid-latex rubber, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), and fabric reinforcement.

C. Available Products:
1. Custom Building Products; Trowel & Seal Waterproofing and Anti-Fracture Membrane.
2. Laticrete International, Inc.; Laticrete HydroBan Waterproof Membrane.
3. Mapei Corporation; PRP M19.

2.04 SETTING MATERIALS

A. Manufacturers:
1. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
2. Bostik Inc: www.bostik-us.com/#sle.
3. Custom Building Products: www.custombuildingproducts.com/#sle.
4. LATICRETE International, Inc: www.laticrete.com/#sle.
5. Mapei Corporation.

B. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.
1. Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.
2. Products:
a. ARDEX Engineered Cements; S 28: www.ardexamericas.com/#sle.
b. Custom Building Products; Complete Contact-LFT Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer: www.custombuildingproducts.com/#sle.
c. LATICRETE International, Inc; LATICRETE 254 Platinum: www.laticrete.com/#sle.

2.05 ADHESIVE MATERIALS

A. Manufacturers:
1. LATICRETE International, Inc; LATICRETE 254 Platinum: www.laticrete.com.
2. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 GROUTS

A. Manufacturers:
1. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
2. Bonsal American, Inc: www.sakrete.com
3. Custom Building Products: www.custombuildingproducts.com/#sle.
4. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Standard Grout: Polymer modified cement grout, sanded, as specified in ANSI A118.7.

2.07 THIN-SET ACCESSORY MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or apprvoed by manufacturer of tile-setting materials for installations indicated.
1. Available Product: Laticrete 3701 Fortified Mortarbed, or approved equal.

B. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

1. Available Product: Maralle Sealants; Miralle #1, or approved equal.

D. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.
   1. Available Product: Miralle Sealants; 511 Impregnator, or approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.

D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances. With floor patch leveler.

D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

E. Install cementitious backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of dry-set mortar to a feather edge.

F. Provide concrete substrates for tile floors installed with thin-set mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
   1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
   2. Remove protrusions, bumps, and ridges by sanding or grinding.

3.03 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1 through A108.13, manufacturer's instructions, and The Tile Council of North America Handbook recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install non-ceramic trim in accordance with manufacturer's instructions.

G. Install thresholds where indicated.

H. Sound tile after setting. Replace hollow sounding units.

I. Keep expansion joints free of adhesive or grout. Apply sealant to joints.

J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

K. Grout tile joints. Use standard grout unless otherwise indicated.

L. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.04 WATERPROOFING AND CRACK-SUPPRESSION MEMBRANE INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.

B. Install crack-supression membrane to comply with manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.

C. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.05 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over concrete substrates, install in accordance with TCA Handbook Method F122, dry-set or latex-portland cement bond coat, over crack - isolation membrane with standard grout, unless otherwise indicated.

3.06 INSTALLATION - WALL TILE

A. Over cementitious backer units on studs, install in accordance with The Tile Council of North America Handbook Method W244, using membrane at toilet rooms.

B. Over gypsum wallboard on wood or metal studs install in accordance with The Tile Council of North America Handbook Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.

C. Over interior concrete and masonry install in accordance with The Tile Council of North America Handbook Method W202, thin-set with dry-set or latex-Portland cement bond coat.

3.07 TESTING

A. Perform a 24-hour flood test for each tile floor area, witnessed by General Contractor and Owner's representative. Install and remove temporary dams and drain plugs required to contain water with the space. Immediately correct conditions that do not pass flood test.

3.08 CLEANING

A. Clean tile and grout surfaces.

3.09 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days or manufacturer's recommended curing time after installation.

END OF SECTION 09 30 00

SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

C. Support hangers, channels, and wires.

D. Supplementary acoustical insulation above ceiling.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 01 78 39 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

C. Section 23 37 00 - Air Outlets and Inlets: Air diffusion devices in ceiling.

D. Section 26 51 00 - Interior Lighting: Light fixtures in ceiling system.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.

1.04 SUBMITTALS

A. See Section 01 30 00 - General Conditions, for submittal procedures.

B. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

C. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.

D. Product Data: Provide data on suspension system components and acoustical units.

E. Samples: Submit two samples 4x4 inch in size illustrating material and finish of acoustical units.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.

1.06 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.07 PROJECT CONDITIONS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Install acoustical units after interior wet work is dry.

1.08 EXTRA MATERIALS

A. See Section 01 60 00 - Product Requirements, for additional provisions.

B. Provide 2% of each type of acoustical unit for Owner's use inmaintenance of project.

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.
   1. Minimum 70 percent pre-consumer recycled content.

B. Acoustical Panels: Mineral fiber with membrane-faced overlay, with the following characteristics:
   1. Application(s): All Rooms.
   2. Classification: ASTM E1264 Type IV.
   3. Size: 24 by 48 inch.
   4. Thickness: 3/4 inch.
   5. Noise Reduction Coefficient (NRC): Not less than 0.70, determined in accordance with ASTM E 1264.
   6. Ceiling Attenuation Class (CAC): Not less than 35, determined in accordance with ASTM E1264.
   7. Panel Edge: Reveal.
   8. Color: White.
   9. Suspension System: Exposed grid, 9/16 inch.
      a. Main Tees: Profiled flange, USG Indentitee DXT MT or equal.
      b. Cross Tees: Flat Flange, USG Centricitee DXT or equal.
   10. Products:
      a. Armstrong World Industries, Inc; Ultima No. 1915 with Beveled Tegular Edge.: www.armstrongceilings.com/#sle.
      b. Certainteed; Sumphony M No. 1220-OVT-1 with Narrow Reveal edge.
      c. USG Corporation; Mars ClimaPlus No. 88985 with FLB edge.: www.usg.com/ceilings/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SUSPENSION SYSTEM(S) UNLESS NOTED OTHERWISE ABOVE.

A. Manufacturers:
   1. Same as for acoustical units.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Suspension Systems - General: ASTM C 635; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.
   1. Materials:
      a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.

2.03 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.

C. Perimeter Moldings: Same material and finish as grid.

D. Gasket For Perimeter Moldings: Closed cell rubber sponge tape.

E. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

A. Install after major above-ceiling work is complete.

B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C 636, ASTM E 580, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:240.

C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size, unless indicated otherwise on reflected ceiling plan

D. Locate system on room axis according to reflected ceiling plan.

E. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

F. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

I. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

J. Do not eccentrically load system or induce rotation of runners.

K. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Install in bed of acoustical sealant or in bed of acoustical sealant.
   2. Use longest practical lengths.
   3. Miter or Overlap and rivet corners.

L. Form expansion joints as detailed. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.

3.04 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Cut to fit irregular grid and perimeter edge trim.
   2. Make field cut edges of same profile as factory edges.
   3. Double cut and field paint exposed reveal edges.

G. Where round obstructions and bullnose corners occur, provide preformed closures to match perimeter molding.

3.05 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION 09 51 00

SECTION 09 65 00
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient tile flooring.

B. Resilient base and pre-molded internal / external corners for tile carpet and resilient tile.

C. Resilient stair accessories.

D. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 09 05 61 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

1.03 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

C. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile.

D. ASTM F1303 - Standard Specification for Sheet Vinyl Floor Covering with Backing.

E. ASTM F1344 - Standard Specification for Rubber Floor Tile.

F. ASTM F1861 - Standard Specification for Resilient Wall Base.

G. BAAQMD 8-51 - Bay Area Air Quality Management District Regulation 8, Rule 51, Adhesive and Sealant Products; www.baaqmd.gov.

H. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

I. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings.

J. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; www.aqmd.gov.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

C. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

E. Verification Samples: Submit two samples, 12x12 inch in size illustrating color and pattern for each resilient flooring product specified.

F. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

G. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.

H. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

I. Maintenance Materials: Furnish the following for North Providence School Department's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Flooring Material: 50 square feet of each type and color.

3. Extra Wall Base: 50 linear feet of each type and color.
4. Extra Stair Materials: Quantity equivalent to 5 percent of each type and color.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum ten years documented experience.

B. Installer Qualifications: Company specializing in installing specified flooring with minimum five years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

D. Do not double stack pallets.

1.07 FIELD CONDITIONS

A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 TILE FLOORING

A. Vinyl Composition Tile: Homogeneous, with uniform color extending throughout thickness
   1. Manufacturers:
      a. Armstrong World Industries, Inc: www.armstrong.com.
      b. Congoleum Corporation.
      c. Tarkett Inc.
      d. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Basis-of-Design: Specifications are based on the flooring product. Equal products by approved manufacturers will be accepted if they meet all the requirements of this section and conform to the detailed requirements of the Drawings.
      a. Armstrong World Industries, Inc., Standard Excelon Imperial Texture
   3. Minimum Requirements: Comply with ASTM F 1066, of Class corresponding to type specified. Composition 1, class 2.
   4. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648.
   5. Size: 12 x 12 inch.
   6. Thickness: 0.125 inch.
   7. Color and Pattern: Five colors in proportions as required to produce random patterns that will be supplied by the Architect.

2.02 STAIR COVERING

A. Stair Treads and Risers: Rubber; full width and depth of stair tread in one piece; tapered thickness; nosing not less than 1-3/4 inch deep.
   1. Manufacturers:
      a. Johnsonite.
      b. Nora Rubber Flooring, Freudenberg Building Systems, Inc.
      c. Mannington Mills.
      d. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Basis-of-Design: Specifications are based on the following product. Equal products by approved manufacturers will be accepted if they meet all the requirements of this section and conform to the detailed requirements of the Drawings.

a. Nor Rubber Flooring, Freudenberg Building Systems, Inc., Norament 925 Grano Stair Treads.

3. Minimum Requirements: Comply with FS RR-T-650 requirements corresponding to type specified.
4. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
5. Configuration: Rubber stair treads with integral risers, furnished in one piece for full coverage of each tread and riser.
6. Nominal Thickness: 0.250 inch.
   a. Tread: Nominal 0.25 inch, tapering to 0.1875 inch at butt edge.
   b. Riser: Nominal 0.25 inch.
7. Nosing: Angled.
8. Texture: Hammered, 1910 Hammered Texture.
9. Color: Solid.
10. Provide striping at top and bottom steps for the visually impaired. Color to be selected by the Architect.

2.03 RESILIENT BASE

A. Resilient Base - Type RB-1: ASTM F 1861, Type TP, rubber, thermoplastic; Style B, Cove, and as follows:
   1. Manufacturers:
      a. Burke Flooring: www.burkeflooring.com/#sle.
      b. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
      c. Basis of Design Product: Roppe Corporation; 700 Series - Thermoplastic Rubber (TPR): www.roppe.com.
      d. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
   3. Height: 4 inch,
   4. Thickness: 0.125 inch thick.
   5. Finish: Satin.
   6. Length: Roll.
   7. Color: To be selected by Architect from manufacturer's full range.
   8. Internal and External Corners: Pre-molded
   9. Accessories: Premolded external corners and end stops.

2.04 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seaming Materials: Waterproof; types recommended by flooring manufacturer.
   1. VOC Content Limits: As specified in Section 01 61 16.

C. Moldings and Edge Strips: Same material as flooring.

D. Filler for Coved Base: Plastic or as recommended by manufacturer.

E. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive resilient flooring.

C. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

D. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

C. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

D. Prohibit traffic until filler is cured.

E. Clean substrate.

F. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install in accordance with manufacturer's instructions.

C. Adhesive-Applied Installation:
   1. Spread only enough adhesive to permit installation of materials before initial set.
   2. Fit joints and butt seams tightly.
   3. Set flooring in place, press with heavy roller to attain full adhesion.

D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
   1. Metal Strips: Attach to substrate before installation of flooring using stainless steel screws.
   2. Resilient Strips: Attach to substrate using adhesive.

F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

G. Install flooring in recessed floor access covers, maintaining floor pattern.

3.04 TILE FLOORING

A. Install in accordance with manufacturer's instructions.

B. Install custom cut/shape per drawings.

C. Mix tile from container to ensure shade variations are consistent when tile is placed, unless manufacturer's instructions say otherwise.

D. Lay flooring with joints and seams parallel or as shown on plans to building lines to produce symmetrical tile pattern.

3.05 RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 48 inches between joints.

B. At external and internal corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.06 INSTALLATION - STAIR COVERINGS

A. Install stair coverings in one piece for full width and depth of tread.

B. Adhere over entire surface. Fit accurately and securely.

3.07 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.08 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION 09 65 00

SECTION 09 90 00
PAINTS AND COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints and other coatings.

C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Exposed surfaces of steel lintels and ledge angles.
   3. Mechanical and Electrical:
      a. In finished areas, paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
      b. In finished areas, paint shop-primed items.

D. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Stainless steel, anodized aluminum, bronze, terne, and lead items.
   6. Floors, unless specifically so indicated.
   7. Glass.
   8. Acoustical materials, unless specifically so indicated.
   9. Concealed pipes, ducts, and conduits.

E. Painting materials and methods for conduit identification specified in Section 26 05 53.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 01 78 39 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.

C. NACE (IMP) - Industrial Maintenance Painting; NACE International; Edition date unknown.

D. SSPC (PM1) - Good Painting Practice: SSPC Painting Manual, Vol. 1; Society for Protective Coatings.

1.04 DEFINITIONS

A. Conform to ASTM D 16 for interpretation of terms used in this section.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

C. Product Data: Provide data on all finishing products and special coatings, including VOC content.

D. Samples: Submit two painted samples, illustrating selected colors and textures for each color and system selected with specified coats cascaded. Submit on paper draw down, 8 x 11 inch in size.

E. Certification: By manufacturer that all paints and coatings comply with VOC limits specified.

F. Manufacturer's Instructions: Indicate special surface preparation procedures and substrate conditions requiring special attention.

G. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum ten years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience.

1.07 REGULATORY REQUIREMENTS

A. Conform to applicable code for flame and smoke rating requirements for products and finishes.

1.08 MOCK-UP

A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.

B. Provide panel, 10 feet long by 8 feet wide, illustrating coating color, texture, and finish.

C. Provide door and frame assembly illustrating coating color, texture, and finish.

D. Locate where directed.

E. Mock-up may remain as part of the work.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.10 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

D. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.11 EXTRA MATERIALS

A. See Section 01 60 00 - Product Requirements, for additional provisions.

B. Supply 1 gallon of each color; store where directed.

C. Label each container with color, type, texture, and room locations in addition to the manufacturer's label.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

B. Paints:
   1. ICI Paints North America: www.icipaints.com
   2. Duron, Inc: www.duron.com/#sle.
   3. Sherwin Williams: www.sherwin-williams.com
   4. Benjamin Moore & Co: www.benjaminmoore.com/#sle.

C. Field-Catalyzed Coatings:

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
   1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
   3. Supply each coating material in quantity required to complete entire project's work from a single production run.
   4. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Volatile Organic Compound (VOC) Content: Comply with Section 01 61 16.

D. Chemical Content: The following compounds are prohibited:
   1. Aromatic Compounds: In excess of 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
   2. Acrolein, acrylonitrile, antimony, benzene, butyl benzyl phthalate, cadmium, di (2-ethylhexyl) phthalate, di-n-butyl phthalate, di-n-octyl phthalate, 1,2-dichlorobenzene, diethyl phthalate, dimethyl phthalate, ethylbenzene, formaldehyde, hexavalent chromium, isophorone, lead, mercury, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, naphthalene, toluene (methylbenzene), 1,1,1-trichloroethane, vinyl chloride.

E. Colors: To be selected from manufacturer's full range of available colors.
   1. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to North Providence School Department.

2.03 PAINT SYSTEMS - INTERIOR

A. Paint I-OP - All Interior Surfaces Indicated to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry, brick, wood, plaster, uncoated steel, shop primed steel, galvanized steel, and aluminum.
   1. Two top coats and one coat primer.
   2. Top Coat(s): Institutional Low Odor/VOC Interior Latex; MPI #143-148.
   3. Eggshell: MPI gloss level 3; use this sheen at all locations.
   4. Top Coat Product(s):
      a. Sherwin-Williams ProMar 200 Zero VOC Interior Latex. (MPI #43, 44, 52, 54, 144)
   5. Primer(s): As recommended by manufacturer of top coats.

B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
   1. Two top coats and one coat primer.
   2. Eggshell: MPI gloss level 3; use this sheen at all locations.

3. Top Coat Product(s):
    a. Sherwin-Williams ProMar 200 Waterbased Acrylic-Alkyd.

C. Paint I-OP-MD-WC - Medium Duty Vertical/Overhead: Including gypsum board.
1. Applications: At Toilet Rooms and at operable plumbing walls.
2. Two top coats and one coat primer.
3. Top Coat(s): Interior Epoxy-Modified Latex; MPI #115, 215.
4. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
5. Top Coat Product(s):
    a. Sherwin-Williams Waterbased Catalyzed Epoxy.
6. Primer(s): As recommended by manufacturer of top coats.

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Gypsum Wallboard: 12 percent.
2. Plaster and Stucco: 12 percent.
3. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
5. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating application.

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

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove or repair existing coatings that exhibit surface defects.

E. Marks: Seal with shellac or stain blocker those which may bleed through surface finishes.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

H. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

I. Insulated Coverings to be Painted: Remove dirt, grease, and oil from canvas and cotton.

J. Aluminum Surfaces to be Painted: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

K. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

L. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-PC 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).

M. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

N. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

O. Interior Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

P. Interior Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

Q. Exterior and Interior Wood to Receive Opaque Latex Stain Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after initial coat has been applied. Back stain concealed surfaces before installation.

R. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.

C. Apply products in accordance with manufacturer's instructions.

D. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

E. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

F. Apply each coat to uniform appearance.

G. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

H. Sand wood and metal surfaces lightly between coats to achieve required finish.

I. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

J. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

K. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Refer to Section 22 05 53, Section 23 05 53 and Section 26 05 53 for schedule of color coding of equipment, duct work, piping, and conduit.

B. Paint shop-primed equipment, where indicated.

C. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

D. Finish equipment, piping, conduit, and exposed duct work in utility areas in colors according to the color coding scheme indicated.

E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.05 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection.

3.06 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.07 PROTECTION

A. Protect finished coatings until completion of project.

B. Touch-up damaged coatings after Substantial Completion.

3.08 SCHEDULE - SURFACES TO BE FINISHED

A. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically noted.
   2. Fire rating labels, equipment serial number and capacity labels.
   3. Stainless steel items.

B. Paint the surfaces described below under Schedule - Paint Systems.

C. Mechanical and Electrical: Use paint systems defined for the substrates to be finished.
   1. Where indicated as exposed, paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment occurring in finished areas to match background surfaces.
   2. Paint all equipment, including that which is factory-finished, exposed to weather or to view on the roof and outdoors.
   3. Paint shop-primed items occurring in finished areas.
   4. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
   5. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

D. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

END OF SECTION 09 90 00

SECTION 10 11 01
VISUAL DISPLAY BOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tackboards.

B. Magnetic Markerboards and Tackboards.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 01 74 19 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

C. Section 06 10 00 - Rough Carpentry: Blocking and supports.

D. Section 09 21 16 - Gypsum Board Assemblies: Concealed supports in metal stud walls.

1.03 REFERENCE STANDARDS

A. ANSI A135.4 - American National Standard for Basic Hardboard.

B. ANSI A208.1 - American National Standard for Particleboard.

C. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling.

D. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

F. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

C. Product Data: Provide manufacturer's data on markerboard, tackboard, trim, and accessories.

D. Shop Drawings: Indicate wall elevations, dimensions, joint locations, special anchor details.

E. Samples: Submit two samples 6 by 6 inch in size illustrating materials and finish, color and texture of markerboard, tackboard, and trim.

F. Test Reports: Show conformance to specified surface burning characteristics requirements.

G. Manufacturer's printed installation instructions.

H. Maintenance Data: Include data on regular cleaning, and stain removal .

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 10 years documented experience.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. AARCO.

B. Alliance Wall Corp.

C. Claridge Products and Equipment, Inc.

D. Forbo Flooring.

E. Greensteel/Korok Division.

F. Polyvision.

G. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 VISUAL DISPLAY BOARDS

A. Magnetic Markerboards: Porcelain enamel on steel, laminated to core.
   1. Color: White.
   2. Metal Face Sheet Thickness: 0.024 inch (24 gage).
   3. Core: Particleboard, 3/8 inch thick, laminated to face sheet.
   4. Backing: Aluminum sheet, laminated to core.
   5. Size: As indicated on drawings.
   6. Frame: Extruded aluminum, with concealed fasteners.
   7. Frame Profile: Standard
   8. Frame Finish: Anodized, satin.
   9. Accessories: Provide chalk tray, map rail, flag holder, and map hooks.
   10. Magnetic.
   11. Basis-of-Design: Claridge Products and Equipment, Series #1.

B. Tackboards, Framed: Composition cork, washable.
   1. Cork Thickness: 1/4 inch.
   2. Color: As selected from manufacturer's full range.
   3. Backing: Hardboard, 1/4 inch thick, laminated to tack surface.
   4. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.
   5. Size: As indicated on drawings.
   6. Frame: Extruded aluminum, with concealed fasteners.
   7. Frame Finish: Anodized, natural, satin.
   8. Basis-of-Design: Claridge Products and Equipment, Cork Bulleting Board, or equal by approved manufacturer.

2.03 MATERIALS

A. Porcelain Enameled Steel Sheet: ASTM A424, Type I, Commercial Steel, with fired-on vitreous finish.

B. Particleboard: ANSI A208.1; wood chips, set with waterproof resin binder, sanded faces.

C. Aluminum Sheet Backing: 0.015 inch thick.

D. Adhesives: Type used by manufacturer.

2.04 ACCESSORIES

A. Map Rail: Extruded aluminum, manufacturer's standard profile, with cork insert, end stops, and runners for accessories; 1 inch wide, full width of frame.

B. Map Supports: Formed aluminum sliding hooks to fit map rail. "One support per two feet of map rail."

C. Temporary Protective Cover: Sheet polyethylene, 8 mil thick.

D. Flag Holders: Cast aluminum bored to receive 1 inch diameter flag staff, bracketed to fit top rail of board (2) per board.

E. Cleaning Instruction Plate: Provide instructions for chalkboard cleaning on a metal plate fastened to perimeter frame near chalkrail.

F. Marker Tray: Aluminum, manufacturer's standard extruded profile closed ends; concealed fasteners,; manufacturer's standard fastening method, same finish as frame.

G. Mounting Brackets: Concealed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated and indicated on shop drawings.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

3.02 INSTALLATION

A. Install boards in accordance with manufacturer's instructions. Mounting height per drawings.

B. Secure units level and plumb.

C. Butt Joints: Install with tight hairline joints.

3.03 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.

B. Cover with protective cover, taped to frame.

C. Remove temporary protective cover at date of Substantial Completion.

END OF SECTION 10 11 01

SECTION 10 14 00
SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Room and door signs.

1.02 REFERENCE STANDARDS

A. ICC A117.1 - Accessible and Usable Buildings and Facilities.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

C. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flat Signs:
   1. ASI Sign Systems, Inc.
   2. Best Sign Systems, Inc: www.bestsigns.com/#sle.
   3. InPro Corporation; Aspen produced in one piece photopolymer media: www.inprocorp.com.
   4. Mohawk Sign Systems, Inc: www.mohawksign.com/#sle.
   5. Seton Identification Products: www.seton.com/aec.
   6. Bayuk Graphic Systems, Inc.
   7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SIGNAGE APPLICATIONS

A. Accessibility Compliance: All signs are required to comply with ADA Standards for Accessible Design and ANSI/ICC A 117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.

2.03 ROOM AND DOOR SIGN TYPES

A. Sign Type at each Classroom

1. Size: Match existing 8"x6"
2. Process: Graphic Blast raised 1/32"
3. Material: .25" MP Plastic
4. Material Finish: Matte
5. Edge Treatment: Standard Bevel
6. Corner Treatment: .5" Radius
7. Border: N/A
8. Copy Size: 1" numerals, .625" letters
9. Typestyle: Helvetica Bold Condensed
10. Braille: Grade II
11. Attachment: Silicone Adhesive & VFT
12. Letter Color: Standard Range
13. Background Color: Standard Range
14. Window Type 1-7"x2" cutout, .30 lexan backplate & Cover
15. Inserts: Paper by Owner
16. Provide blanks when mounted to glass

2.04 ACCESSORIES

A. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs where indicated:
   1. Room and Door Signs: Locate on wall at latch side of door with centerline of sign at 60 inches above finished floor.
   2. If no location is indicated obtain North Providence School Department's instructions.

D. Protect from damage until Substantial Completion; repair or replace damage items.

END OF SECTION 10 14 00

SECTION 10 14 19

DIMENSIONAL LETTER SIGNAGE

PART 1 GENERAL

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

2.02 DIMENSIONAL LETTERS

A. Applications: Building identification.
   1. Use individual metal letters.
   2. Mounting Location: Exterior as indicated on drawings.
   3. Allow for total of 50 letters, 6 inches high.

B. Metal Letters:
   1. Material: Stainless steel sheet, fabricated reverse channel.
   2. Thickness: 1/8 inch minimum.
   3. Letter Height: _____ inches.
   4. Text and Typeface:
      a. Character Font: Helvetica, Arial, or other sans serif font.
   5. Finish: Brushed, satin.
   6. Color: As selected.
   7. Mounting: Concealed screws.

2.03 ACCESSORIES

A. Concealed Screws: Noncorroding metal; stainless steel, galvanized steel, chrome plated, or other.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install with horizontal edges level.

C. Locate dimensional letter signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION 10 14 19

SECTION 10 21 13.19
PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Recycled plastic toilet compartments.

1.02 REFERENCE STANDARDS

A. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

1.03 ADMINISTRATIVE REQUIREMENTS

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

C. Product Data: Provide data on panel construction, hardware, and accessories.

D. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

E. Samples: Submit two samples of partition panels, 4 by 4 inch in size illustrating panel finish, color, and sheen.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Solid Plastic Toilet Compartments:
   1. Accurate Partitions Corporation.
   2. Bradley Corporation; Mills Partitions.
   3. Capitol Partitions, Inc.
   4. General Partitions Mfg. Corp.
   5. Santana Products, Inc.
   6. Substitutions: Section 01 60 00 - Product Requirements.

2.02 PLASTIC TOILET COMPARTMENTS

A. Recycled Plastic Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid recycled polyethylene material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color and pattern throughtout thickness of material, tested in accordance with NFPA 286; floor-mounted unbraced.
   1. Color: One color in each room as selected by Architect from Manufacturer's full range of colors and patterns.
   2. Configuration: Overhead Braced Units.
      a. Provide Manufacaturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conseal supports and leveling mechanism.
   3. Doors:
      a. Thickness: 1 inch.
      b. Width: 24 inch.
      c. Width for Handicapped Use: 36 inch, out-swinging.
      d. Height: 55 inch.
   4. Panels:
      a. Thickness: 1 inch.
      b. Height: 55 inch.
   5. Pilasters:
      a. Thickness: 1 inch.

b. Width: As required to fit space; minimum 3 inch.

2.03 ACCESSORIES

A. Pilaster Shoes: Stainless steel, satin finish, 3 inches high; concealing floor fastenings.

B. Head Rails: Extruded aluminum, anti-grip profile.

C. Wall and Pilaster Brackets: Stainless steel; manufacturer's standard type for conditions indicated on drawings.

D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.

E. Hinges: Stainless steel, manufacturer's standard finish.

F. Door Hardware: Stainless steel, manufacturer's standard finish.
   1. Door Latch: Slide type with exterior emergency access feature.
   2. Door Strike and Keeper with Rubber Bumper: Mount on pilaster in alignment with door latch.
   3. Provide door pull for outswinging doors.

G. Coat Hook: One per compartment, mounted on door.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION 10 21 13.19

SECTION 10 28 00

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Under-lavatory pipe supply covers.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00: Concealed supports for accessories, including in wall framing and plates.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

D. ASTM C1036 - Standard Specification for Flat Glass.

E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.

F. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror.

G. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping.

H. ICC A117.1 - Accessible and Usable Buildings and Facilities.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

C. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

D. Schedule: Submit schedule indicating accessories, quantity and location.

E. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Commercial Toilet, Shower, and Bath Accessories:
   1. American Specialties, Inc: www.americanspecialties.com/#sle.
   2. Bobrick Washroom Equipment, Inc: www.bobrick.com
   3. Bradley Corporation: www.bradleycorp.com/#sle.
   4. Substitutions: Section 01 60 00 - Product Requirements.

B. Under-Lavatory Pipe Supply Covers:
   1. ISP Corporation: Trubro, Lav Guard 2.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

B. Stainless Steel Sheet: ASTM A666, Type 304.

C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

D. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

2.04 COMMERCIAL TOILET ACCESSORIES

A. Toilet Paper Dispenser: Cascades PRO Tandem Side-by-Side High Capacity Toilet Paper Dispenser (C312)

B. Sanitary Napkin Disposal: Bobrick B-353 Commercial Restroom Sanitary Napkin/Tampon Disposal, Recessed-Mounted, Stainless Steel

C. Soap Dispenser: SCJohnson Professional, Proline Curve Dispenser, TPB1LDS with catch tray

D. Paper Towel Dispenser: Cascades PRO Tandem Mechanical No-touch Roll Towel Dispenser (C340)

E. 36" Horizontal Grab Bar, Bobrick B-5806

F. 42" Horizontal Grab Bar, Bobrick B-5806

G. 18" Vertical Grab Bar, Bobrick B-5806

H. Toilet Seat Cover Dispenser: Bobrick B-4221

I. Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.
   1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
   2. Frame: 0.05 inchangle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
   3. 24 x 36 inches.
   4. Products:
      a. AJW Architectural Products: www.ajw.com/#sle.
      b. Bobrick, B-1658 1836.
      c. Substitutions: Section 01 60 00 - Product Requirements.

2.05 COMMERCIAL SHOWER AND BATH ACCESSORIES

A. Refer to schedule on drawings.

2.06 UNDER-LAVATORY PIPE AND SUPPLY COVERS

A. Under-Lavatory Pipe and Supply Covers:
   1. Insulate exposed drainage piping including hot, cold, and tempered water supplies under lavatories or sinks to comply with ADA Standards.
   2. Construction: 1/8 inch flexible PVC.
   3. Color: White.
   4. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces.
   5. Products:
      a. ISP Corporation: Trubro, Lav Guard 2.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. See Section 06 10 00 for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

END OF SECTION 10 28 00

SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers.

B. UL (DIR) - Online Certifications Directory.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

C. Product Data: Fire extingushers and cabinets.

D. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

E. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:
   1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com/#sle.
   2. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
   3. Larsen's Manufacturing Company: www.larsens.com
   4. Nystrom, Inc: www.nystrom.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fire Extinguisher Cabinets and Accessories:
   1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com/#sle.
   2. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
   3. Larsen's Manufacturing Co: www.larsensmfg.com/#sle.
   4. Nystrom, Inc: www.nystrom.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gage.
   1. Class: 3A 40B:C type.
   2. Size: 5 pound nominal capacity.

2.03 FIRE EXTINGUISHER CABINETS

A. Cabinet Construction: Non-fire rated.

B. Cabinet Configuration: Recessed type.
   1. Size to accommodate accessories.

C. Basis-of-Design: Larsen's 2409 5 inch ID Architectural Series

D. Finish of Cabinet Exterior Trim and Door: Red enamel.

E. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

B. Cabinet Signage: On cabinet door.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure rigidly in place.

C. Place extinguishers in cabinets.

3.03 MAINTENANCE

A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

END OF SECTION 10 44 00

SECTION 10 51 00
LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal lockers.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 01 78 39 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's published data on locker construction, sizes and accessories.

C. Shop Drawings: Indicate locker plan layout, numbering plan and combination lock code.

D. Manufacturer's Installation Instructions: Indicate component installation assembly.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Lockers:
   1. Penco Products, Inc; Product Vanguard: www.pencoproducts.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 LOCKER APPLICATIONS

A. Student Lockers: Two tier metal lockers, wall mounted with matching closed base.
   1. Width: 12 inches.
   2. Depth: 12 inches.
   3. Height: 30 inches. Total 60"
   4. Fittings: Hat shelf, 2 coat hooks.
   5. Locking: Padlock hasps, for padlocks provided by Owner.
   6. Provide sloped top at two tier metal lockers only.

2.03 METAL LOCKERS

A. Lockers: Factory assembled, made of formed sheet steel, ASTM A653/A653M SS Grade 33/230, with G60/Z180 coating, stretcher leveled; metal edges finished smooth without burrs; baked enamel finished inside and out.
   1. Where ends or sides are exposed, provide flush panel closures.
   2. Provide filler strips where indicated, securely attached to lockers.
   3. Color: To be selected by Architect.

B. Locker Body: Formed and flanged; with steel stiffener ribs; electric spot welded.
   1. Body and Shelves: 24 gage, 0.024 inch.
   2. Base: 20 gage, 0.036 inch.
   3. Metal Base Height: 4 inch.

C. Frames: Formed channel shape, welded and ground flush, welded to body, resilient gaskets and latching for quiet operation.
   1. Door Frame: 16 gage, 0.060 inch, minimum.

D. Doors: Formed from one piece cold rolled sheet steel. Formations shall consist of a full channel shape on all sides.
   1. Door Outer Face: 18 gage, minimum.
   2. Form recess for operating handle and locking device.
   3. Provide louvers in door face, top and bottom, for ventilation.

E. Hinges: Two for doors under 42 inches high; three for doors over 42 inches high; weld securely to locker body and door.
   1. Hinge Thickness: 14 gage, 0.075 inch.

F. Sloped Top: 20 gage, 0.036 inch, with closed ends.

G. Trim: 20 gage, 0.036 inch.

H. Filler panels: 20 gage, 0.036 inch.

I. Coat Hooks: Stainless steel or zinc-plated steel.

J. Number Plates: Provide oval shaped brass plates, block font style with ADA designation in contrasting color

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install lockers plumb and square.

C. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 lb.

D. Bolt adjoining locker units together to provide rigid installation.

E.

F. Install accessories.

G. Replace components that do not operate smoothly.

3.02 CLEANING

A. Clean locker interiors and exterior surfaces.

END OF SECTION 10 51 00

SECTION 10 75 00
FLAGPOLES

PART 1 GENERAL

PART 2 PRODUCTS

2.01 FLAGPOLES

A. Flagpoles: Designed in accordance with NAAMM FP 1001.
   1. Material: Aluminum.
   2. Design: Cone tapered.
   3. Mounting: Ground mounted type.
   4. Outside Butt Diameter: ____ inches.
   5. Outside Tip Diameter: ____ inches.
   6. Nominal Height: ____ ft; measured from nominal ground elevation.
   7. Halyard: Internal type, electric operation.

2.02 ACCESSORIES

A. Finial Ball: Aluminum, 6 inch diameter.

B. Halyard: 5/16 inch diameter nylon, braided, white.

2.03 OPERATORS

A. Hand Crank: Removable _____ type.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install flagpole, base assembly, and fittings in accordance with manufacturer's instructions.

END OF SECTION 10 75 00

SECTION 10 82 13
EXTERIOR GRILLES AND SCREENS

PART 1 GENERAL

PART 2 PRODUCTS

2.01 GRILLES

A. Aluminum Grilles: Provide shop fabricated, shop finished grilles assembled into panels.
   1. Grill Type: Flat bar/egg crate.
   2. Grille Type: Tubular shape.
   3. Panel Size and Configuration: As indicated on drawings.
   4. Frame/Support: Extruded aluminum tube or flat aluminum bar.

2.02 SCREENS

A. Aluminum Screens: Provide shop fabricated, shop finished screens assembled into panels.
   1. Screen Type: Perforated metal sheet.
   2. Screen Type: Laser-cut metal sheet.
   3. Panel Size and Configuration: As indicated on drawings.
   4. Frame/Support: Extruded aluminum tube or flat aluminum bar.

B. Polycarbonate Mesh Screens: Provide shop or field fabricated, vertically tensioned polycarbonate mesh panels attached to subframes.
   1. Mesh Panel Framing: Manufacturer's standard extruded aluminum side tracks and top and bottom stainless steel tubes.
   2. Subframe: Steel angle to fully frame mesh panel system, 3-1/4 inch by 3-1/4 inch minimum, provided by others.
   3. Mesh Characteristics:
      a. Physical Open Area: 80 percent.
      b. Visual Open Area: 25 percent.
      c. Mesh Screen Thickness: 5/8 inch.
   4. Configuration: As indicated on drawings.
   5. Sizes: As indicated on drawings.

2.03 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

B. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils thick.

C. Natural Anodized Finish with Organic Seal: AAMA 612 Clear anodic coating with non-aqueous electro-deposited organic seal; not less than 0.7 mils thick.

D. Color Anodized Finish with Organic Seal: AAMA 612 Electrolytically deposited colored anodic coating with non-aqueous electro-deposited organic seal; not less than 0.7 mils.

E. Superior Performing Organic Coatings: AAMA 2605; multiple coats, thermally cured polyvinylidene fluoride system.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's written installation instructions.

B. Set grilles level, plumb, with uniform joints, and in alignment with adjacent work as indicated.

C. Mechanically secure grilles to supporting structure.

D. Do not cut or trim aluminum members without approval of manufacturer; do not install damaged members.

END OF SECTION 10 82 13

SECTION 11 40 00
FOODSERVICE EQUIPMENT

PART 1 GENERAL

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Equipment Schedule: Refer to schedule at end of this section.

B. Installation Accessories: Provide rough-in hardware, supports and connections, attachment devices, closure trim, and accessories as required for complete installation.

2.02 MATERIALS

A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

B. Stainless Steel Sheet: ASTM A666 Type 304 commercial grade, No. 4 finish.

C. Glass: ASTM C1036, annealed, and laminated, 4 mm thick; exposed edges ground; cut or drilled to receive hardware.

D. Plastic Laminate: NEMA LD 3, HGS; acid-resistant; _____ color; textured, low gloss finish.

E. Finish Hardware: Manufacturer's standard.

F. Work Surfaces: Solid, laminated maple.

G. Fittings: Sink drains with crumb cup and waste fittings.

H. Service Outlet Covers and Escutcheons: Stainless Steel.

2.03 FABRICATION

A. Install rubber button feet on bearing surface of any item positioned on a finished surface.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify ventilation outlets, service connections, and supports are correct and in required location.

B. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install items in accordance with manufacturers' instructions.

B. Insulate to prevent electrolysis between dissimilar metals.

END OF SECTION 11 40 00

SECTION 11 53 13
LABORATORY FUME HOODS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Standard laboratory fume hoods.
B. Fume hood base cabinets and stands.
C. Exhaust blowers.
D. Work surfaces.
E. Laboratory cup sinks in fume hoods.
F. Service fittings and outlets.
G. Airflow indicators and alarms.

PART 2 PRODUCTS

2.01 CONSTANT AIR VOLUME (CAV) FUME HOODS

A. Bypass Fume Hoods:

2.02 VARIABLE AIR VOLUME (VAV) FUME HOODS

2.03 PERFORMANCE REQUIREMENTS

A. Fume hoods complying with the following when tested in accordance with ASHRAE Std 110:
   1. As-Manufactured (AM) Rating: AM 0.01 (0.01 ppm).
   2. As-Installed (AI) Rating: AI 0.10 (0.10 ppm).
   3. Average Face Velocity: 100 FPM (0.51 m/s) plus or minus 10 percent with sashes fully open.
   4. Face-Velocity Variation: Not more than 10 percent of average face velocity across the face opening with sash(es) fully open.
   5. Release Rate: 4.0 L/min.
   6. Static-Pressure Loss: Not more than 1/2-inch w.g. (124 Pa) at 100 FPM (0.51 m/s) face velocity with sash fully open when measured at four locations 90 degrees apart around the exhaust duct and at least three duct diameters downstream from duct collar.

2.04 FUME HOODS

A. General Requirements:
   1. Comply with SEFA 1.
B. Type ___, Fume Hood:
   1. Ventilation: Variable Air Volume (VAV).
   2. Configuration: Standing-height; bench mounted.
   3. Nominal Interior Height: 48 inches.
   4. Sash Type: Vertical rising.
      a. Leak-free enclosure box, manufacturer's standard construction, for vertical rising sash.
      b. Glazing: Laminated safety glass.
      c. Sash Guides: Corrosion-resistant polyvinyl chloride (PVC) track.
      d. Vertical Sash mechanism: Designed to prevent sash drop in case of mechanism failure.
         1) Cable: Minimum 3/32 inch (2 mm) thick stainless steel of construction standard with the manufacturer.
      e. Vertical Sash Pull: Type 316 stainless steel, with No.4 finish.
   5. Top Front Panel: Standard integral grille stamped into panel of same materials as fume hood exterior.
   6. Exterior: Sheet steel.
   7. Interior Lining: Polypropylene.

8. Service Fittings and Fixtures:
9. Access Panels: Provide removable panels on both sides hood exterior and interior lining panels.
10. Work Surface:

C. Fume Hood Base Cabinets:
1. Exterior construction: Wood Cabinets.
2. Material: Sheet steel.
3. Color/Finish: As indicated on drawings.

D. Light Fixtures: UL labeled, vaporproof, one-tube, T-5 fluorescent light fixtures. Number and length of fixtures as necessary for fume hood width. Mounted above sealed safety glass panel. White baked-enamel finish on fixture interior.

2.05 FABRICATION

A. General: Assemble fume hoods in factory to greatest extent possible. Disassemble fume hoods only as necessary for shipping and handling limitations, or as necessary to permit movement through a 35 inches by 79 inches clear door opening.

B. Ends: Fabricated with double-wall end panels. Close area between double walls at front of fume hood and as needed to house sash counterbalance weights, utility lines, and remote-control valves.

C. Lining Assembly: Unless otherwise indicated, assembled with stainless-steel fasteners or epoxy adhesive, concealed where possible. Joints sealed by filling with chemical-resistant sealant during assembly.
1. Punched fume hood lining side panels for service fittings and remote controls. Removable plug buttons for holes not used for indicated fittings.

D. Rear Baffle: Same material as fume hood lining, unless otherwise indicated, at rear of hood with openings at top and bottom, with corrosion-resistant fasteners. Fabricated for removal to facilitate cleaning behind baffle.

E. Exhaust Plenum: Full width of fume hood, sized and configured to provide uniform airflow, of same material as hood lining, and with duct stub for exhaust connection.
1. Duct-Stub Material: Epoxy-coated steel, unless otherwise indicated.

F. Airfoil: At bottom of fume hood face opening, with 1 inch gap between bottom of airfoil and work top. Sash to close on top of airfoil. Designed to direct airflow across work.
1. Fabricated from 14 gauge, 0.0781 inch stainless steel with No.4 finish.

G. Comply with requirements of other sections for factory installation of water and laboratory gas service fittings, piping, electrical devices, and wiring. Securely anchor fittings, piping, and conduit to fume hoods, unless otherwise indicated.

2.06 MATERIALS

A. Steel Sheet: Cold-rolled, commercial steel (CS) sheet, complying with ASTM A1008/A1008M; matte finish; suitable for exposed applications.

B. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Fasteners: Stainless-steel, where exposed to fumes.

2.07 ACCESSORIES

A. Differential Pressure Gauge: Direct-reading aneroid gauge that measures the difference in static pressure between the laboratory space and the fume hood exhaust duct.

B. Airflow Monitors/Indicators and Alarms: Provide each fume hood with a airflow monitor/indicator complete with an audible and visual alarm that activates when airflow sensor reading is outside of preset range.

1. Source: Fume hood manufacturer.
2. Airflow Monitor/Indicator Functionality:
3. Airflow Alarm functionality: Audible (85 dB @ 4 inch distance), and visual alarm that activates when airflow sensor reading is outside of preset range.
    a. Reset and test mode.
    b. Programmable Switch: Designed to silence audible alarm and automatically reset when airflow returns to within preset range. Warning light to stay on when alarm is silenced.
    c. Capability for integration with BAS (Building Automation System) via BACnet.

2.08 EXHAUST BLOWERS

A. Dedicated exhaust blower at each fume hood indicated to be individually exhausted, of airflow capacity recommended by fume hood manufacturer.
    1. Type: Direct drive.
    2. Materials: Epoxy-coated steel.
    3. Controls: On/Off using Fan switch located on fume hood post.
    4. Model selection coordinated with building electrical services.
    5. Model selection coordinated with expected static pressure losses in exhaust ductwork.

2.09 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Factory testing of each type of fume hood.

C. Non-Complying Work: See Section 01 40 00.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Install fume hoods according to manufacturer's written instructions. Install level, plumb, and true; shim as required, using concealed shims, and securely anchor to building and adjacent laboratory casework. Securely attach access panels but provide for easy removal and secure reattachment. Where fume hoods abut other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

B. Comply with indicated requirements for installing water and laboratory gas service fittings, and electrical and telecommunications devices.

C. Exhaust Blowers:
    1. Turn over to appropriate trade contractor(s) for installation.

3.02 CLEANING

A. Clean finished surfaces, including both sides of glass; touch up as required; and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

3.03 DEMONSTRATION

A. Demonstrate proper operation of fume hoods and their accessories to North Providence School Department's designated representative.

END OF SECTION 11 53 13

SECTION 11 61 43
STAGE CURTAINS

PART 1 GENERAL

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Stage Curtain Systems Design: Engage qualified designer to develop design of stage curtain system, including comprehensive project specific analysis of necessary structural system attachments in compliance with performance requirements.

B. Structural Performance: Ensure attachment of stage curtain system to structure withstands material weight and operational loads applicable for this project and in compliance with local building codes and authorities having jurisdiction.
   1. Design Loads: Weight of stage curtains and track system.

C. Fire-Test Characteristics: Stage curtain fabrics in compliance with NFPA 701 flame propagation fire test requirements conducted by authorized testing agency, listed by UL (DIR), ITS (DIR), or FM (AG) and acceptable to authorities having jurisdiction.
   1. Permanently attach label to fabric of each curtain assembly indicating fabric treatment as follows:

D. Electrical Components: Devices that are listed and labeled in compliance with NFPA 70, by a qualified testing agency, and marked for designated application.

2.02 STAGE CURTAIN FABRICS

A. Provide curtains of matching fabric and color from single dye lot, and when size and quantity of curtains exceeds maximum dye lot size, provide curtain or adjacent pair of curtains from only one dye lot, and arrange curtain dye lots to minimize exposure of any differences.

B. Type A - Polyester Velour: Weighing at least 25 oz/linear yd, napped fabric of 100 percent polyester with minimum pile height of 75 mil, 0.075 inch and minimum width of 54 inches.
   1. Application: Main Traveler, Main Valance, Olio Traveler, Olio Legs, Olio Valance, Cyclorama Traveler, Cyclorama Legs, Cyclorama Border, and _____ curtains
   2. Color: As selected by Architect from manufacturer's full range.
   3. Texture: As selected by Architect from manufacturer's full range.
   4. Pattern: As selected by Architect from manufacturer's full range.

C. Type C - Polyester Velour: Weighing at least 14 oz/linear yd, napped fabric of 100 percent polyester with minimum pile height of 75 mil, 0.075 inch and minimum width of 62 inches.
   1. Application: Olio Traveler, Olio Legs, Olio Valance, Cyclorama Traveler, Cyclorama Legs, Cyclorama Border, and _____ curtains.
   2. Color: As selected by Architect from manufacturer's full range.
   3. Texture: As selected by Architect from manufacturer's full range.
   4. Pattern: As selected by Architect from manufacturer's full range.

D. Type D - Doral Opaque - Repp Fabric: Weighing at least 21 oz/linear yd, woven fabric of 35 percent modacrylic, 35 percent rayon, and 30 percent saran, with vinyl backing and 48-inch minimum width.
   1. Application: Main Traveler, Main Valance, Olio Traveler, Olio Legs, Olio Valance, Cyclorama Traveler, Cyclorama Legs, Cyclorama Border, Safety, Classroom, and _____ curtains.
   2. Color: As selected by Architect from manufacturer's full range.
   3. Texture: As selected by Architect from manufacturer's full range.
   4. Pattern: As selected by Architect from manufacturer's full range.

2.03 LININGS

A. Type LA - Light-Weight Polyester Lining: Weighing at least 10 oz/linear yd, 100 percent polyester fabric; 72-inch minimum width.
   1. Color: Black.

2.04 MUSLIN

A. Type MA - Muslin: Weighing at least 4.5 oz/linear yd, sheer, plain woven fabric of 100 percent cotton with 118-inch minimum width.
   1. Application: Cyclorama, Skydrop, Backdrop, and _____ curtains.
   2. Color: As selected by Architect from manufacturer's full range.

2.05 SCRIMS AND DROPS

A. Type SA - Scrim: Lightweight seamless gauze flat sewn fabric with an open weave.
   1. Application: Cyclorama, Skydrop, Backdrop, and _____ curtains.
   2. Color: As selected by Architect from manufacturer's full range.

2.06 GREEN SCREENS

A. Type GS - Green Screen Fabric:
   1. Application: Cyclorama, Skydrop, and Backdrop.
   2. Color: As selected by Architect from manufacturer's full range.

2.07 CURTAIN TRACK

A. Aluminum Track: Extruded aluminum, ASTM B221(ASTM B221M); alloy and temper as recommended by manufacturer as required for strength and corrosion resistance; mill finish; including support and operation accessories.
   1. Thickness: As recommended by manufacturer for curtain loads and operation.
      a. Heavy-Duty: 0.125-inch minimum thickness.

B. Curtain Rails: Provide single or double curtain capacity as indicated on drawings, and end stops.

C. Operation:

D. Track System: Provide heavy-duty curtain track with components as recommended by manufacturer for loads and operation, including track end stops.
   1. Carriers: Standard plated-steel carriers with a pair of nylon tired ball-bearing wheels riveted parallel to body, and equip carriers with rubber or neoprene bumpers to reduce noise and plated-steel swivel eye and trim chain for attaching curtain snap or S-hook, and required number of curtain carriers for track length and curtain fabrication.
      a. Master Curtain Carriers: One plated-steel master carrier for each leading curtain edge, with two pairs of nylon tired ball-bearing wheels and with two line guides per carrier.
   2. Pulleys: One dead-end, single-wheel pulley; one live-end, double-wheel pulley; and one adjustable pulley to maintain proper tension on operating line; each with molded-nylon-tired ball-bearing sheaves enclosed in steel housings; pulleys with steel housing finished to match track and with bracket for securing off-stage end of curtain.

2.08 CURTAIN TRACK OPERATORS

A. General: Provide operating machine as recommended by track manufacturer of size and capacity for each motorized curtain as indicated on drawings, with electric motor and factory wired motor controls, starter, gear-reduction unit, brake, and control station.

B. Type of Operator:

C. Motor: In compliance with NEMA MG 1 requirements, and sized to start, accelerate, and operate curtain in either direction and from any position on track at rated speeds and service factor.
   1. Electrical Characteristics: 120 VAC; 3-phase; 60 hertz; continuous running duty type.
   2. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with electrical system available for each location.

D. Controllers, Disconnect Switches, Wiring and Wiring Devices: Manufacturer's standard, unless otherwise indicated.

E. Control Station: Momentary contact, three-button control station with push-button controls labeled - Open, Close, and Stop.

1. Enclosures: Key-accessed and keyed alike, with one key for each enclosure and one extra key.
2. Switches: Key-operated and keyed alike, with one key for each switch and one extra key.

F. Limit Switches: Fully closed and fully opened preset stops.

2.09 FABRICATION - CURTAINS

A. General: Provide vertical seams unless otherwise indicated, locate vertical seams so they do not fall on faces of pleats, and only use fabric that is cut greater than half the width of fabric.

B. Vertical and Top Hems: Machine sew hems as follows, unless otherwise indicated:
1. Vertical Hems: Fabricate at least 2 inches wide, and at least 4 inches wide at borders, valances, teasers, and tormentors with at least 1-inch tuck and without visible selvedge material from front of curtain; sew open ends of hems closed.
2. Turnbacks: Fabricate leading-edge and trailing-edge turnbacks for traveler curtains by folding back at least 12 inches of face fabric, with at least 1-inch tuck, and vertically secured by sewing.
3. Top Hems: Fabricate by double-stitching 3-1/2-inch wide heavy jute or laminated synthetic webbing to top edge at back side of curtain, and with at least 2 inches of face fabric turned under.

C. Fullness:

D. Grommets:

E. Bottom Hems: Machine sew hems as follows, unless otherwise indicated:

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. Install stage curtain assembly in accordance with curtain and track manufacturers written instructions.

3.02 INSTALLATION - CURTAIN

END OF SECTION 11 61 43

SECTION 11 66 23
GYMNASIUM EQUIPMENT

PART 1 GENERAL

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. See drawings for sizes and locations, unless noted otherwise.

B. Provide mounting plates, brackets, and anchors of sufficient size and strength to securely attach equipment to building structure; comply with requirements of Contract Documents.

C. Hardware: Heavy duty steel hardware, as recommended by manufacturer.

D. Electrical Wiring and Components: Comply with NFPA 70; provide UL-listed equipment.

E. Structural Steel Fabrications: Welded in accordance with AWS D1.1/D1.1M, using certified welders.

2.02 GYMNASIUM DIVIDER CURTAINS

A. Gymnasium Divider Curtains:
   1. Curtain Material: Class A rated, self-extinguishing vinyl coated polyester complying with NFPA 101.
   2. Upper Section: 9 oz/sq yd vinyl mesh fabric.
   3. Lower Section: 18 oz/sq yd solid vinyl coated polyester.
   4. Operation: _____.
   5. Width: As indicated on drawings.

2.03 BASKETBALL

A. Basketball System: Backstop assembly, backboard, and goal.

B. Wall-Mounted Backstop Assemblies: Wall-mounted steel frame assembly capable of mounting both rectangular and fan-shaped backboards.
   1. Framing: Stationary framing.
   2. Framing Color: Manufacturer's standard.

C. Column-Mounted Backstop Assemblies: Column-mounted; stationary; mounted to exposed column flange; capable of mounting both rectangular and fan-shaped backboards.
   1. Framing Color: Manufacturer's standard.

D. Ceiling-Suspended Backstop Assemblies: Capable of mounting both rectangular and fan-shaped backboards.
   1. Framing: Center strut; forward folding framing.
   2. Folding Control System: Electric hoist that folds backstop with 115 volt actuator, integral limit switches that provide automatic shut-off in both positions, and safety catch with automatic reset.
   3. Framing Color: Manufacturer's standard.

E. Backboards: Tempered glass, rectangular shaped.
   1. Frame: Brushed aluminum edge, steel mounting.
   2. Markings: Painted.
   3. Color: Manufacturer's standard.

F. Goals: Steel rim, mounted to backboard, with attached nylon net; complete with mounting hardware.
   1. Net Attachment Device: Tube-tie.
   2. Finish: Powder coat orange.

2.04 FLOOR-MOUNTED EQUIPMENT

A. Volley Ball Nets and Posts: One court system of adjustable posts, net, and tensioning winch meeting requirements for FIVB, USA Volleyball, NCAA and NFHS competition requirements.

1. Posts: 3-1/2 inch O.D. schedule 80 aluminum tube with 1 inch height adjustments between 42 and 96 inches.
2. Net: 4 inch square #36 nylon cord with vinyl coated polyester hem, double stitched around the perimeter.
3. Tensioning Winch: Manual crank heavy duty, self-locking worm gear mechanism.

B. Floor Anchors for Portable Gymnasium Equipment: Steel plate bolted into wood flooring, with center screw-down button for securing tensioned elements; installed flush with finish floor surface.
1. Screw Size: 1/2 inch diameter, with 13 threads per inch.

C. Floor Sleeves for Posts: Metal sleeve, with latch cover, cast into concrete subfloor to hold poles for nets and goals; installed flush with finish floor surface.
1. Latch Cover: Brass, round; tamper resistant lock with key.
2. Sleeve: Aluminum.
3. Depth of Sleeve: 9 inches from floor surface to bottom, including latch cover.

2.05 WALL PADDING

A. Wall Padding: Foam filling bonded to backing board, wrapped in covering; each panel fabricated in one piece.
1. Covering: Vinyl-coated polyester fabric, mildew and rot resistant; stapled to back of board.
a. Color: As selected from manufacturer's standard range.
b. Texture: Embossed leather-look.
c. Fabric Weight: 14 oz/sq yd, minimum.
2. Foam: Soft, urethane or polyurethane, with 3.5 pcf nominal density.
3. Foam Thickness: 1-1/2 inches.
4. Backing Board: Plywood.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with Contract Documents and manufacturer's instructions.

B. Coordinate installation of inserts and anchors that must be built in to flooring or subflooring.

C. Install equipment rigid, straight, plumb, and level.

D. Secure equipment with manufacturer's recommended anchoring devices.

E. Install wall padding securely, with edges tight to wall and without wrinkles in fabric covering.

F. Separate dissimilar metals to prevent electrolytic corrosion.

END OF SECTION 11 66 23

SECTION 12 24 00
WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior manual roller shades.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of affected installers.

B. Sequencing:
   1. Do not fabricate shades until field dimensions for each opening have been taken with field conditions in place.
   2. Do not install shades until final surface finishes and painting are complete.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.

D. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.

E. Certificates: Manufacturer's documentation that line voltage components are UL listed or UL recognized.

F. Source Quality Control Submittals: Provide test reports indicating compliance with specified fabric properties.

G. Selection Samples: Include fabric samples in full range of available colors and patterns.

H. Verification Samples: Minimum size 6 inches square, representing actual materials, color and pattern.

I. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

J. Project Record Documents: Record actual locations of control systems and show interconnecting wiring.

K. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.

L. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in North Providence School Department's name and registered with manufacturer.

M. Maintenance contracts.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

B. Installer Qualifications: Company specializing in performing work of this type with minimum five years of documented experience with shading systems of similar size and type.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.

B. Handle and store shades in accordance with manufacturer's recommendations.

1.07 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
   1. Shade Hardware: 25 years.
   2. Fabric: 25 years.
   3. Aluminum and Steel Coatings: One year.
   4. Shade Installation: 2 years

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Interior Manually Operated Roller Shades:
   1. Draper, Inc: www.draperinc.com/#sle.
   2. MechoShade Systems LLC; Mecho/5 System: www.mechoshade.com/#sle.
   3. Nysan Shade Systems Ltd.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

2.02 ROLLER SHADES

A. General:
   1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
   2. Provide shade system that operates smoothly when shades are raised or lowered.

B. Roller Shades Type 1 - Basis of Design: MechoShade Systems LLC; Mecho/5 System; www.mechoshade.com/#sle.
   1. Description: Single roller, manually operated fabric window shades.
      a. Drop Position: Regular roll.
      b. Mounting: Ceiling mounted.
      c. Fabric: As indicated under Shade Fabric article.
   2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
   3. Roller Tubes:
      a. Material: Extruded aluminum.
      b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
      c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
      d. Roller tubes to be capable of being removed and reinstalled without affecting roller shade limit adjustments.
   4. Hembars: Designed to maintain bottom of shade straight and flat.
      a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
   5. Clutch Operator: Manufacturer's standard material and design integrated with bracket/brake assembly.
      a. Provide a permanently lubricated brake assembly mounted on an oil-impregnated hub with wrapped spring clutch.

b. Brake must withstand minimum pull force of 50 pounds in the stopped position.
c. Mount clutch/brake assembly on the support brackets, fully independent of the roller tube components.

6. Drive Chain: Continuous loop stainless steel beaded ball chain, 95 pound minimum breaking strength. Provide upper and lower limit stops.
   a. Chain Retainer: Chain tensioning device complying with WCMA A100.1.
7. Accessories:
   a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; clear anodized finish.
      1) Profile: Square.
      2) Configuration: Continuous, fascia extends past continuous bracket.
   b. Fasteners: Noncorrosive, and as recommended by shade manufacturer.

2.03 SHADE FABRIC

A. Fabric for Light-Filtering Shades: Nonflammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
   1. Manufacturers:
      a. MechoShade Systems LLC; ThermoVeil Basket Weave - 1500 Series (3% open): www.mechoshade.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Material: Vinyl coated polyester.
   3. Performance Requirements:
      a. Flammability: Pass NFPA 701 large and small tests.
      b. Fungal Resistance: No growth when tested according to ASTM G21.
   4. Openness Factor: 3%.
   5. Color: As selected by Architect from manufacturer’s full range of colors.

2.04 ROLLER SHADE FABRICATION

A. Field measure finished openings prior to ordering or fabrication.

B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
   1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window stool.
   2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.

C. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

B. Start of installation shall be considered acceptance of substrates.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Replace shades that exceed specified dimensional tolerances at no extra cost to North Providence School Department.

C. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.03 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

C. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.

3.04 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

3.05 PROTECTION

A. Protect installed products from subsequent construction operations.

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

3.06 MAINTENANCE

A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide to North Providence School Department, a proposal as an alternate to the base bid, a separate renewable maintenance contract for the service and maintenance of a motorized shade system for one year from date of Substantial Completion. Include a complete description of preventive maintenance, systematic examination, adjustment, parts and labor, cleaning, and testing, with a detailed schedule.

END OF SECTION 12 24 00

SECTION 12 32 16

MANUFACTURED PLASTIC LAMINATE CASEWORK

PART 1 GENERAL

1.01 SUMMARY

A. Related Documents:
   1. Drawings and provisions of the contract including General Conditions Supplementary Conditions and Division 1, apply to this section.

B. Section Includes:
   1. Furnish and install plastic laminate casework and accessories as shown and listed on drawings and specified herein. Includes all countertops, supports, shelving, and filler panels necessary for a complete casework installation.

C. Related Requirements to be Performed by Others:
   1. Division 06 Section: “Rough Carpentry” for blocking within walls to adequately support casework.
   2. Division 07 Section: “Preformed Joint Seals” for caulking of casework and/or countertops to abutting walls.
   3. Division 09 Section: “Resilient Base and Accessories” for resilient base applied to manufactured casework.

1.02 REFERENCES

A. ANSI-A135: for all hardboard.

B. ANSI-A161.2-1998: for performance of fabricated high-pressure decorative laminate countertops.

C. ANSI-A208.1-2009: for grade M-2 mat-formed wood particleboard.

D. BHMA A156.9: for grade-2 hinge requirements.

E. NEMA 3 LD-2005: for performance requirements of high pressure laminates.

1.03 DEFINITIONS

A. Grain Direction:
   1. Wood grained and directionally grained laminates shall run vertically on doors, exposed cabinet ends, modesty panels, countertop supports and finished backs. Grain runs horizontally on drawer fronts, aprons and light valances.

B. Exposed Surfaces:
   1. In casework, surfaces visible when drawers and opaque doors (if any) are closed; open cabinet interiors and interiors behind clear glass doors; exterior cabinet bottoms 42” or more A.F.F.; exterior cabinet tops 80” or less A.F.F. or seen from above;
   2. Exposed cabinet surfaces shall be: NEMA LD-3-2005 VGS High Pressure Decorative Laminate (HPDL).
      a. Full range of Formica, Wilsonart, Pionite and Nevamar laminates.

C. Semi-Exposed Surfaces:
   1. In casework, surfaces that become visible when opaque doors are open or drawers are extended; bottoms of cabinets less than 42” A.F.F.; exterior cabinet tops more than 80” A.F.F. and not seen from above. wall mounted shelving.
   2. Semi-Exposed cabinet surfaces shall be: Low pressure decorative laminate (LPDL).
      a. Full range of Formica, Wilsonart, Pionite and Nevamar laminates. Frosty white, natural almond or fashion grey.

D. Concealed Surfaces:
   1. Exterior or interior surfaces that are covered or not normally exposed to view.
   2. Surfacing material at manufacturer’s option. No exposed (raw) cabinet surfaces are permitted.

1.04 SUBMITTALS

A. North East Collaborative for High Performance Schools (NECHPS) Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

B. Shop Drawings:
   1. Comply with Division 1.
   2. Submit three sets of laser quality, 11 x 17 shop drawings consisting of:
      a. Finish, hardware, construction options selection sheet.
      b. Small scale floor plan showing casework in relation to the building.
      c. Large scale elevations and plan views.
      d. Cross-sections; service runs; locations of blocking within walls (blocking is done by others); rough-in requirements and, sink centerlines
   3. Approved shop drawings to be returned to manufacturer at least 60 days before production.
   4. Project Architect and Construction Manager must approve all items prior to fabrication and delivery of casework.
   5. Manufacturer and/or Manufacturer's rep verifies all critical building dimensions prior to fabrication.

C. Samples:
   1. Submit one set of laminate color brochures from standard laminate manufacturers Wilsonart, Formica, Pionite, and Nevamar.
   2. Submit one edge color sample chain.
   3. Submit one set of interior colors samples.

D. Warranty:
   1. Provide sample warranty document stating specified terms as referenced in 1.8.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Must have been engaged in the manufacture of institutional casework for a minimum of ten years.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:
   1. Deliver casework once painting, and similar requirements have been completed that will not damage casework. This includes ensuring spaces are enclosed and weather tight.
   2. All casework shall be blanket wrapped for protection during shipping.

B. Storage and Handling:
   1. Casework must be protected from dust, dirt and/or other trades.
   2. Countertops are stacked, properly supported and spaced evenly to avoid warping. Large pieces are stacked first on the pallets with shorter pieces stacked on top.

1.07 SITE CONDITIONS

A. Ambient Conditions:
   1. Do not deliver or install the casework until concrete, masonry, and drywall/plaster work is dry; ambient relative humidity is maintained between 25 - 55% prior to delivery and throughout the life of installation; and the temperature is controlled above 55
   2. Casework shall not be stored or installed in non-climate controlled conditions.
   3. If ambient conditions are not met at the time of requested delivery, the general contractor or owner must provide the casework manufacturer a letter releasing manufacturer from any liability and responsibility from any warranty or damage resulting from not complying with required ambient conditions.

1.08 WARRANTY

A. The casework manufacturer shall offer a one year warranty to the original owner against defective material and workmanship.

1. The warranty specifically does not cover any product or hardware, which has been incorrectly installed, including poor climate conditions, exposed to excessive loads or abuse.
2. All non-casework items supplied, but not manufactured, by the casework manufacturer including, but not limited to, sinks, fixtures, apparatus, fume hoods, keyboard trays, spray booths, lights, power outlets, and power strips shall be covered under the original manufacturers' warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Approved Manufacturers:
   1. Case Systems, 2700 James Savage Road, Midland, Michigan 48642 (989) 496-9510 and/or Case Systems approved dealers.

B. Substitution Limitations:
   1. Additional manufacturers may submit substitution requests in accordance with procurement substitution and/or substitution procedures, or provide a comparable product with the following support information detailed below:
      a. Written documentation stating specification compliance regarding construction, materials, and standard of quality and manufacturing techniques.
      b. Note all deviations to the drawings and/or specifications in writing.
      c. Provide the Architect with a full-scale base cabinet not less than ten days prior to bid date. The sample shall represent typical construction and materials for the product the casework manufacturer proposes, meeting the quality standards set forth by this specification. The sample may be impounded by the owner and retained until completion of the casework installation.
      d. The owner, or its designated representative, reserves the right to reject any proposal that in his opinion fails to meet the criteria established by this specification. Such a decision shall be final.

2.02 MATERIALS

A. Provide Plastic Laminate Faced Cabinets Manufactured with:
   1. Particleboard Core:
      a. M-2 CARB2 compliant for emission levels of urea formaldehyde, and shall meet or exceed all requirements as set by ANSI A208.1-2009.

Density	40-50 lbs/cu.ft
Moisture Content	10% Max
Modulus of Rupture	2393 psi
Modulus of Elasticity	398,900 psi
Internal Bond	80 psi
Hardness	500 pounds Min
Linear Expansion	0.0035
Thickness Tolerance	+/- 0.008"
Face Screw Holding	247 pounds Min

   2. Environmentally responsible forest management:
      a. For products having chain-of-custody certificates certifying that the wood used in the casework complies with FSC requirements.
   3. Low Emitting Core shall be:
      a. ULEF/FSC (No added Urea Formaldehyde) M-2 Particleboard:
         1) For casework core having recycled content.
         2) For casework core being manufactured without the use of urea formaldehyde.
         3) For products having chain-of-custody certificates certifying that the wood used in the casework complies with FSC requirements.

B. Joinery:
   1. Mechanical Joinery:
      a. All cabinet body components shall be secured utilizing concealed mechanical fasteners as approved by the AWS Quality Standards, Edition -1, Section 10 - Casework.

C. Surface Material:
   1. Acceptable laminate color, pattern, and finish as either scheduled or otherwise indicated on drawings or as selected by Architect from manufacturer's standards types and nominal thickness including:
      a. General purpose vertical grade VGS HPDL. Choose full range of Formica, Wilsonart, Pionite and Nevamar laminates.
      b. General purpose horizontal grade HGS HPDL. Choose full range of Formica, Wilsonart, and Nevamar laminates.
      c. Cabinet decorative liner grade CLS
      d. Non-decorative backer grade BKH
      e. Low pressure decorative laminate
      f. Chemical resistant decorative laminate

D. Edge banding:
   1. PVC
      a. Shall be applied utilizing hot melt adhesive and radiused by automatic trimmers. Edging shall be available in a variety of color options.

E. Adhesives:
   1. PVA
      a. Adhesive shall be mechanically applied.
      b. ULEF, no VOC
   2. EVA
      a. Adhesive shall be mechanically applied.

2.03 FABRICATION

A. General Cabinet Body Construction:
   1. Cabinet Box Style shall be Flush Overlay Fronts.
   2. Cabinet Box Core shall be FSC certified, ULEF M2 particleboard.
   3. Sink Cabinet Box Core shall be FSC certified, ULEF M2 particleboard.
   4. Bottoms and ends of cabinets, and tops of tall cabinets and tops and bottoms of wall cabinets (all structural components) shall be 3/4-inch thick.
   5. All panels shall be manufactured with balanced construction. Cabinet components may use CLS cabinet liner or BKH backer to balance VGS HPDL laminate at semi-exposed and non-exposed surfaces.
   6. Fixed interior components such as fixed shelves, dividers, and cubicle compartments shall be full 3/4" thick and attached with concealed interlocking mechanical fasteners.
   7. Fixed and adjustable shelves at open cabinets shall be 1" thick.
   8. Cabinet body exterior surfaces shall be considered Exposed Surfaces.
   9. Open cabinet interior surfaces and interiors behind clear glass doors shall be considered Exposed Surfaces.
   10. Closed cabinet body interior surfaces shall be considered Semi-Exposed Surfaces.
   11. Visible cabinet bottoms (e.g. wall cabinet bottoms) shall be considered Exposed if 42" or more A.F.F., Semi-Concealed between 24" and 42" and Concealed below 24": A.F.F.
   12. Visible cabinet tops (e.g. wall cabinet tops, hutch cabinet tops, tall cabinet tops) shall be considered Exposed if 80" or less A.F.F. or if visible from above and Concealed if more than 80" A.F.F. and not visible from above.
   13. Cabinet edges:
      a. Cabinet body front edge shall be: 3mm Thick PVC.
      b. Top edge of wall, tall, and hutch cabinet ends shall be:
      c. All other edges shall be: unfinished.

14. Mounting stretchers are 3/4" thick structural components fastened to end panels and back by mechanical fasteners, and are concealed by the cabinet back.
15. When the rear of a cabinet is exposed, a separate finished 3/4" thick decorative laminate back panel may be required.
16. Backs of cabinets are 1/2" thick surfaced both sides for balanced construction and fully captured on both sides and bottom.
17. A 5mm diameter row hole pattern 32mm (1-1/4") on center shall be bored in cabinet ends for adjustable shelves. This row hole pattern shall also serve for hardware mounting and replacement and/or relocation of cabinet components.

B. Tall Cabinet Construction:
   1. All tall cabinets shall be provided with an intermediate fixed shelf to maintain internal dimensional stability under heavy loading conditions as well as an intermediate 3/4" thick stretcher located behind the back panel, secured between the cabinet ends with mechanical fasteners. The stretcher shall be secured to the shelf through the back with #8 x 2" plated flat head screws.

C. Tall and Wall Cabinet Top Edges shall be unfinished if not visible from above or nominal 1mm PVC edgeband matching the cabinet box edge if visible from above.

D. Tall, Wall and Hutch Tops shall be considered Exposed or Semi-Exposed based on visibility as previously defined. Semi-Exposed surfaces shall utilize BKL, LPDL or CLS. LPDL and CLS shall match the color selected for Semi-Exposed surfaces.

E. Reveal above the top door and drawer front shall be a maximum of 15mm for all cabinets.

F. Toe Base of Cabinet:
   1. Individual bases shall be constructed of: FSC certified, ULEF M-2 particleboard factory applied to base and tall cabinets and shall support and carry the load of the end panels, and the cabinet bottom, directly to the floor. The base shall be let in from the sides and back of the cabinet to allow cabinets to be installed tightly together and tight against a wall, also to conceal the top edge of applied vinyl base molding (not supplied by casework manufacturer). There shall be a front to back center support for all bases over 30" wide.
   2. Toe Base Height: 3-3/4” unless noted otherwise on the drawings to permit shimming to accommodate variances in the floor.
   3. Toe bases shall be securely attached to the base cabinet at the manufacturer.

G. Drawer Fronts and Solid Doors:
   1. All drawer fronts and solid door components shall be: 11/16” thick FSC certified, ULEF M-2 industrial particleboard surfaced both sides for balanced construction.
   2. Exterior of door and drawer fronts shall be surfaced with VGS HPDL, balanced with either VGS HPDL or CLS cabinet liner at Semi-Exposed interior surfaces and with VGS HPDL on Exposed interior surfaces. The interior surface of a glazed door is an Exposed Surface.
   3. Door and drawer front edge shall be: machine applied 3mm thick PVC radiused to eliminate sharp edges and corners.

H. Drawer Boxes:
   1. Drawer box core shall be FSC certified, ULEF M-2 industrial particleboard
   2. Drawer box surface at finished interiors shall match semi-exposed interior finish.
   3. Drawer box sides, backs and sub-front shall be ½” thick, carried by a non-racking, non-deflecting ½” thick plant-on bottom mechanically fastened to the sides, sub-front and back 4” on center. The top edge shall be nominal 1mm (.020") PVC matching the drawer color. Drawer box corners shall be joined with fluted hardwood dowels and glue spaced at a minimum of 32mm on center.
   4. Bottom mount slides are secured with 1-1/4" long screws driven through the plant-on bottom up into the sides. Side-mount slides are secured with ½” long screws driven into the drawer box sides. Drawer box fronts shall be removable and attached to drawer box sub-front with screws from inside of drawer. Screws shall be located a maximum of 1-1/2” from the inside corner of the sub-front and shall be spaced a maximum of 12” on center. Horizontal parting rails between drawers shall be 3/4" thick core, with balanced surfaces,

secured to and further reinforcing cabinet ends. File drawer box shall have full-height sides supporting a heavy-duty support rail for hanging file folders.

I. Doors:
   1. Solid Doors shall be surfaced both sides for balanced construction.

J. Shelves:
   1. Adjustable:
      a. Adjustable Shelf Core shall be: FSC certified, ULEF M-2 industrial particle board.
      b. Adjustable shelves in closed cabinets shall be: 3/4” Shelves, 1" for shelves over 33" wide.
      c. All adjustable shelves in open cabinets shall be: 1" thick, except for special use cabinets such as mail, cubical, instrument or locker type units.
      d. Adjustable shelf edge on open cabinets shall be: nominal 1mm PVC at front edge
      e. Adjustable shelf edge on closed cabinets shall be: nominal 1mm PVC at front edge
      f. Adjustable shelf shall be set back a maximum of 15mm from the front of the cabinet.
   2. Fixed:
      a. Fixed shelves shall be FSC certified, ULEF M2 particleboard. Top and bottom surfaces shall be the same.
      b. Fixed shelves shall be 3/4” thick at closed cabinets, 1” thick at open cabinets.
      c. Fixed shelf surfaces on closed cabinets shall be LPDL.
      d. Fixed shelf surfaces on open cabinets shall be HPDL.
   3. Wall shelving on standards and brackets shall be:
      a. Fixed shelves shall be FSC certified, NAUF M2 particleboard. Top and bottom surfaces shall be the same.
      b. Edged all four edges with nominal 1mm PVC
      c. Surfaced with LPDL
   4. Wire Shelves shall be white, plastic coated.
   5. Hardboard Shelves shall be ¼" thick tempered hardboard. All hardboard shall have a “S2S” surface finish.

K. Specialty Products:
   1. Countertops:
      a. For dry countertops, HPDL bonded to FSC certified, ULEF M-2 industrial particleboard core with PVA rigid adhesives. Core shall be balanced with backing Grade BKL.

2.04 FINISHES

A. Plastic Laminate Casework Colors:
   1. High Pressure Laminate is available in non-premium, non-specialty and manufacturers’ standard suede finishes from our select laminate manufacturers, including:
      a. Full range of Formica, Wilsonart and Nevamar laminates.
      b. Color: Specialty and other manufacturer finishes are available with additional cost and longer lead times.
   2. LPDL, where specified, that meets performance requirements of ANSI/NEMA 3 LD - 2005 for GP-28.
      a. Natural Almond (Wilsonart D30)] or Fashion Grey (Wilsonart D381) or Frosty White (Wilsonart 1573) or equivalent.
   3. Cabinet Liner, where specified, high-pressure cabinet liner conforming to ANSI/NEMA 3 LD - 2005, Grade CLS. Surface texture shall be similar to exterior finish.
      a. Almond, Grey or White closely matched to LPDL colors.

B. Plastic Laminate Countertop Colors:
   1. Full range of Formica, Wilsonart, Pionite and Nevamar laminates.
   2. Color: Specialty and other manufacturer finishes are available with additional cost and longer lead times.

C. Accessories:

1. Hinges:
    a. Flush overlay, fully concealed, self closing hinge, 170 degree swing, zinc finish,
2. Pulls:
    a. 8mm x 96mm Anodized aluminum wire pull.

2.05 ACCESSORIES

A. Hardware:
1. Hinges:
    a. Flush Overlay Concealed Hinges shall be: fully concealed, nickel-plated, self-closing, 170 degree swing European style with six way adjustment. Hinge shall be: a minimum of Grade 2 per ANSI/BHMA A156.9. Hinge shall permit door to swing 170 degrees without binding. Doors under 36" high shall have two hinges; 36"-72" high shall have three hinges; over 72" high shall have four hinges.
2. Pulls:
    a. One pull shall be: located at the centerline of the drawer, regardless of width, to ensure ease of operation and maximize drawer slide life.
        1) Anodized aluminum wire pull, 8mm diameter with 96mm O.C. mounting holes
3. Drawer Slides:
    a. Pencil drawers: Grade 1, bottom mount, ¾ extension, 100lb load rated, epoxy coated, roller bearing.
    b. General purpose drawers: Grade 1, bottom mount, ¾ extension, 100lb load rated, epoxy coated, roller bearing.
    c. Letter and legal file drawers less than 20” wide: Grade 1, bottom mount, full extension, 100lb load rated, epoxy coated, roller bearing.
    d. Lateral file drawers less than 30" wide and paper storage drawers: Grade 1, side mount full extension, 150lb load rated, zinc finish, ball bearing.
    e. Lateral file drawers 30" or wider: Grade 1, side mount full extension, 150lb load rated, zinc finish, ball bearing.
4. Wall Shelving Hardware:
    a. Regular duty wall single track and heavy duty double track shelving hardware, including standards and brackets, are available in an anochrome finish.
    b. Bracket Mounted Shelf Core shall be FSC certified, ULEF M-2 industrial particleboard
    c. Bracket Mounted Shelf Edge shall be: nominal 1mm PVC.
    d. Bracket Mounted Shelf Surface shall be LPDL
5. Shelf Clips:
    a. Shelf clips shall be injected molded clear plastic, with a double pin engagement 32mm on center and shall have 3/4" and 1" anti-tip locking tabs. Shelf clips for all 1/4" hardboard shelves shall be: single pin plastic with anti-tip locking tabs.
6. Coat Hooks shall be Zinc plated, single prong and double prong as detailed on the Architectural drawings.
7. Closet Rods shall be Zinc plated rod, 1" diameter with captive sockets.
8. Mirrors:
    a. Teacher wardrobe mirrors to be 8" x 10".
9. Label Holders shall be provided as detailed on the Architectural drawings.
10. Locks
    a. Lock Locations:
        1) Locks at all doors.
    b. Lock Type:
        1) Manufacturer’s standard 5 disc tumbler cam lock
    c. Keying:
        1) Locks keyed alike within a room, keyed differently between rooms.
11. Catches:
    a. Chain Pulls shall be zinc plated, spring loaded door catch used to hold door securely shut.

b. Chain Stops shall be zinc plated, looped chain used to limit door swing as specified, mounting plate at each end of chain shall use (4) #7 x 5/8" screws to secure to cabinet door and end panel. They shall be on cabinets at adjoining walls and where casework and countertops can interfere with the door swing of the tall cabinet.
c. Elbow Catch shall be chrome plated, spring loaded, used to hold non-locking door securely shut.
d. None provided for self-closing hinges.

PART 3 EXECUTION

3.01 INSTALLERS

A. Installation shall be: by casework manufacturer's authorized representative.

3.02 INSTALLATION

A. Casework shall not be: installed until concrete, masonry, and drywall/plaster work is dry.
   1. If ambient conditions are not met at the time of requested delivery, the general contractor or owner must provide Case Systems a letter that releases manufacturer from any liability and responsibility from any warranty or damage resulting from not complying with required ambient conditions.

B. Casework shall be: installed plumb and true and is to be securely anchored in place.

C. The casework contractor shall verify all critical building dimensions prior to fabrication of casework.

D. Provide all labor for unloading, distribution, and installation of casework and related items as specified.

E. All casework shall be: securely anchored to horizontal wall blocking, not to plaster lathe or wall board.

F. The casework manufacturer shall re-configure the casework arrangements to dimensions requiring 2-1/2" or less of filler at each end of wall-to-wall elevations, and to ensure a complete and satisfactory installation.

G. The casework installer shall remove all debris, sawdust, scraps, and leave casework spaces clean.

H. All casework must be installed by casework installer plumb and level, adjust all doors, drawers and hardware to comply with manufacturers specifications and operate properly.

END OF SECTION 12 32 16

SECTION 12 48 10

ENTRANCE FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of fhis Section of the Specifications.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
   1. Recessed Foot Grilles: Deep-construction aluminum foot grilles.
   2. Recessed Entrance IVlats: Deep-construction aluminum entrance mats with carpet inserts.
   3. Walk-Off Tiles (Recessed and Surface Mounted). Polypropylene rubber backed modular tiles.
   4. Substrate preparation for entrance mats and accessories.

B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Northeast Collaborative for High Performance Schools — (NE-CHPS). Project scores will be verified by a third party certified.
   1. Refer to section 018113 — Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
   2. Refer to section 018119 - Indoor Air Quality Requirements for material and procedure requirements.

C. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
   1. Section 033000 - CAST-IN-PLACE CONCRETE for concrete work, including forming, placing, and finishing concrete floor slabs, and for concrete materials for grouting and filling around and under recessed mats and frames.

1.03 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet — See Section 018113 — Sustainable Design Requirements.

C. Shop Drawings: Show the following:
   1. Items penetrating floor mats and frames, including door control devices.
   2. Divisions between mat sections.
   3. Perimeter floor moldings.

D. Samples for Initial Selection: For each type of product indicated.
   1. Floor Mat: 12-inch- square, assembled sections of floor mat.
   2. Frame Members: 12-inch- long Sample of each type and color.

E. Maintenance Data: For floor mat and frames to include in maintenance manuals.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain floor mats and frames through one source from a single manufacturer.

B. Accessibility Requirements: Provide installed floor mats that comply with Section 4.5 in the U.S. Architectural & Transportation Barriers Compliance Board’s "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)” and the New Hampshire Architectural Access Board.

1.05 PROJECT CONDITIONS

A. Field Measurements: Indicate measurements on Shop Drawings.

1.06 COORDINATION

A. Coordinate size and location of recesses in concrete with installation of finish floors to receive floor mats and frames.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers oWering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Recessed Deep Construction Aluminum Foot grilles and Entrance Mats:
      a. Bolar
      b. Mats Incorporated.
      c. Musson, R. C. Rubber Co. (The).

2.02 METAL FRAME MATERIALS

A. Extruded Aluminum: ASTM B 221 alloy 6061-T6 or alloy 6063-T5, T6, or T52 as standard with manufacturer.

2.03 CONCRETE FILL AND GROUT MATERIALS

A. Provide concrete materials complying with Section 033000 - CAST-IN-PLACE CONCRETE for grout and fill around and under recessed mats and frames that produce concrete equivalent in strength to cast-in-place concrete slabs. For concrete fill, adjust aggregate size to not exceed one-third fill thickness.

2.04 FLOOR MATS

A. General: Provide colors, patterns, and profiles of materials, including metals and metal finishes indicated or specified. If not indicated, provide colors, patterns, and profiles selected by Architect from manufacturer’s standards.

B. Recessed Aluminum Foot Grilles for Exterior: Provide recessed foot grilles with non-slip aluminum treads and with the following properties:
   1. Sizes: As indicated on Drawings.
   2. Units shall be designed for installation flush with adjacent concrete pavement in recess as shown on Drawings.
   3. As far as possible, each foot grille shall be fabricated in one piece, or pieces as large as feasible for each installation.
   4. Tread Rails: T-shaped extruded aluminum rails, secured with bolted cross supports at 6 inches (152 mm) on center
      a. Rail Material: 6063-T52 aluminum alloy extrusions, mill finish.
      b. Rail Profile: 1 inch (25 mm) deep, with top flange 1/8 inch (3 mm) thick and 3/8 inch (9.5 mm) wide.
      c. Spacing: Maximum 3/16 inch (4.8 mm) gap between top flanges.
   5. Treads: Linear.
   6. Basis of Design Product: Mats, Inc., Ultra Track, or equal by approved manufacturer.

C. Recessed Aluminum Entrance Mats for Vestibules: Constructed from aluminum alloy type 6061-T6 fabricated as grilles to sizes indicated with mechanically fastened rails (swedge or key lock fastening of rails is unacceptable) and, where applicable, with finishes and profiles specified by the architect for use as entrance mat system as follows:
   1. T-shaped blades, 1-5/16 by 1/8 by 1-1/2 inch size with Polyimide Nylon fiber inserts; combined with Y-shaped blades, 11/16 by 1/8 by 1-1/2 inch size with an anti-slip polymer C9065 insertion of Durometer 90/65, 1/4 inch thick and locked in at each end. Spacing between blades not to exceed 3/16 inch.
   2. Perimeter Frames: Angle "L" frame or inverted “T", either "Level" or "Embedded” depending on the installation. Aluminum frames shall be pre-assembled at factory incorporating welded construction for all joints. Each grille section shall incorporate a non-visible section divider integrated and welded within the frame. Frames and grilles shall

be shipped fully assembled in protective wooden crating to each jobsite. For sections larger than 6 by 8 feet a mechanical joint is to be provided.

3. Basis of Design Product: Dual Track as manufactured by Mats Inc., or approved equal.

2.05 FABRICATION

A. General: Where possible, verify sizes by field measurement before shop fabrication.

B. Floor Mats: Shop fabricate units to greatest extent possible in sizes as indicated. If not otherwise indicated, provide single unit for each mat installation ; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

C. Recessed Metal Mat Frames: Extruded aluminum of size and style to fit floor mat type specified, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devices.

1. Fabricate edge-frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.

D. With manufacturer's standard protective coating, coat surfaces of aluminum frames that will contact cementitious material.

2.06 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.07 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

2.08 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by entrance mat manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed entrance mat and is recommended by entrance mat manufacturer for releasable installation.

1. VOC Limits: Provide adhesives with VOC content not more than 50g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrate for compliance with requirements for location, sizes, minimum recess depth, and other conditions affecting installation of floor mats and frames.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install entrance mats and mat frames to comply with manufacturer's written instructions. Set mat tops at height recommended by manufacturer for most effective cleaning action; coordinate top of mat surfaces with bottom of doors that swing across mats to provide clearance between door and mat.

1. Install necessary shims, spacers, and anchorages for proper location and secure attachment of frames.
2. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.

3.03 PROTECTION

A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

B. Defer installation of floor mats until Project is near Substantial Completion.

END OF SECTION 12 48 10

SECTION 14 24 00

HYDRAULIC ELEVATORS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies hydraulic elevators.

B. Work Required:
   1. The work required under this section consists of all labor, materials and services required for the complete installation (including operational verification) of all the equipment required for the elevator(s) as herein specified.
   2. Access control of elevators.
   3. All work shall be performed in a first class, safe and workmanlike manner.
   4. In all cases where a device or part of the equipment is herein referred to in the singular, it is intended that such reference shall apply to as many of such devices or parts as are required to make complete installation.

C. Related work not specified herein: The following sections contain requirements that relate to this section and are performed by trades other than the elevator manufacturer/installer.
   1. Section 01 50 00 - Construction Facilities and Temporary Controls: protection of floor openings and personnel barriers; temporary power and lighting.
   2. Section 03 30 00 - Cast-In-Place Concrete: elevator pit, elevator motor and pump foundation, and grouting thresholds.
   3. Section 04 20 00 - Unit Masonry: masonry hoistway enclosure, building-in and grouting hoistway door frames, grouting thresholds.
   4. Section 05 50 00 - Metal Fabrications: pit ladder, divider beams, support for entrances and rails, hoisting beam at top of hoistway.

D. Applicable Codes: Comply with applicable building and elevator codes at the project site, including but not limited to the following:
   1. ANSI A117.1, Buildings and Facilities, Providing Accessibility and Usability for Physically Handicapped People.
   2. ADAAG, Americans with Disabilities Act Accessibility Guidelines.
   3. ANSI/NFPA 70, National Electrical Code.
   4. ANSI/NFPA 80, Fire Doors and Windows.
   5. ASME/ANSI A17.7, Safety Code for Elevators and Escalators.
   6. ANSI/UL 10B, Fire Tests of Door Assemblies.
   7. CAN/CSA C22.1, Canadian Electrical Code.
   8. CAN/CSA-B44, Safety Code for Elevators and Escalators.
   9. EN 12016 (May 1998): “EMC Product Family Standards for lifts, escalators, and passenger conveyors Part 2 – immunity”
   10. Local Building Codes.
   11. All other local applicable codes.

1.02 SYSTEM DESCRIPTION

A. Equipment Description: Holeless Hydraulic elevator with Machine-Room Less application

B. Equipment Control: Digital, closed-loop, microprocessor-based, control system.

C. Quantity of Elevators: One

D. Elevator Stop Designations: First Floor, Second Floor

E. Stops : 2

F. Openings: Front openings.

G. Travel (maximum): 13’-2”.

H. Rated Capacity: 3500 lb.

I. Rated Speed: 125 fpm.

J. Platform Size: 6’-6 ¾” W x 5’-7 ¾” D

K. Clear Inside Dimensions: 6’-5 9/16” W x 5’-0 3/16” D

L. Cab Height: 7’-9”

M. Clear Cab Height: 7’-9” with 5/16” floor recess and 4 LED ceiling

N. Entrance Type and Width: Single-Slide Door 3’ 6”

O. Entrance Height: 7’ 0”

P. Main Power Supply: 480 Volts, 3-Phase, 60Hz + or - 5% of normal, three-Phase, with a separate equipment grounding conductor.

Q. Car Lighting Power Supply: 120 Volts, Single-phase, 15 Amp, 60 Hz.

R. Machine and Controller Location: No machine-room required, tank and controller in hoistway pit.

S. Signal Fixtures: Manufacturer’s standard with stainless steel metal button targets (exc. CA).

T. Controller Location: Inside hoistway, accessible by a door in a side hoistway wall on the 1st or 2nd landing. (1st landing only if rear entrance)

U. Stopping Accuracy: ±1/4" (6.4 mm) under any loading condition or direction of travel.

V. Operation: Simplex Collective Operation: Using a microprocessor-based controller, operation shall be automatic by means of the car and hall buttons. If all calls in the system have been answered, the car shall park at the last landing served.

W. Operating Features – Standard
1. Full Collective Operation
2. Fan and Light Protection.
3. Full Collective Operation.
4. Firefighters' Service Phase I and Phase II
5. Top of Car Inspection.

X. Operation Features – Optional
1. None

Y. Door Control Features:
1. Door control to open doors automatically when car arrives at a landing in response to a normal hall or car call.
2. Elevator doors shall be provided with a reopening device that will stop and reopen the car door(s) and hoistway door(s) automatically should the door(s) become obstructed by an object or person.
3. Door protection shall consist of a two dimensional, multi-beam array projecting across the car door opening.
4. Door nudging operation to occur if doors are prevented from closing for an adjustable period of time.

Z. Provide equipment according to seismic zone: 1

1.03 SUBMITTALS

A. Product Data: Submit manufacturer’s product data for each system proposed for use. Include the following:
1. Signal and operating fixtures, operating panels and indicators.
2. Cab design, dimensions and layout.
3. Hoistway-door and frame details.
4. Electrical characteristics and connection requirements.
5. Expected heat dissipation of elevator equipment in hoistway (BTU).
6. Color selection chart for Cab and Entrances.

B. Shop Drawings: Submit approval layout drawings. Include the following:
1. Car, guide rails, buffers and other components in hoistway.
2. Maximum rail bracket spacing.

3. Maximum loads imposed on guide rails requiring load transfer to building structure.
4. Clearances and travel of car.
5. Clear inside hoistway and pit dimensions.
6. Location and sizes of access doors, hoistway entrances and frames.

C. Operations and Maintenance Manuals: Provide manufacturer's standard operations and maintenance manual.

1.04 QUALITY ASSURANCE

A. Manufacturer: Elevator manufacturer shall be ISO 9001 certified.

B. Installer: Elevators shall be installed by the manufacturer.

C. Permits, Inspections and Certificates: The Elevator Contractor shall obtain and pay for necessary Municipal or State Inspection and permit as required by the elevator inspection authority, and make such tests as are called for by the regulations or such authorities. These tests shall be made in the presence of such authorities or their authorized representatives.

1.05 DELIVERY, STORAGE AND HANDLING

A. Should the building or the site not be prepared to receive the elevator equipment at the agreed upon date, the General Contractor will be responsible to provide a proper and suitable storage area on or off the premises.

B. Should the storage area be off-site and the equipment not yet delivered, then the elevator contractor, upon notification from the General Contractor, will divert the elevator equipment to the storage area. If the equipment has already been delivered to the site, then the General Contractor shall transport the elevator equipment to the storage area. The cost of elevator equipment taken to storage by either party, storage, and redeliver to the job site shall not be at the expense of the elevator contractor.

1.06 WARRANTY

A. The elevator contractor’s acceptance is conditional on the understanding that their warranty covers defective material and workmanship. The warranty period shall not extend longer than one (1) year from the date of completion or acceptance thereof by beneficial use, whichever is earlier, of each elevator. The warranty excludes: ordinary wear and tear, improper use, vandalism, abuse, misuse, or neglect or any other causes beyond the control of the elevator contractor and this express warranty is in lieu of all other warranties, express or implied, including any warranty of merchantability or fitness for a particular purpose.

1.07 MAINTENANCE AND SERVICE

A. Maintenance service consisting of regular examinations and adjustments of the elevator equipment shall be provided by the elevator contractor for a period of twelve (12) months after the elevator has been turned over for the customer’s use. This service shall not be subcontracted but shall be performed by the elevator contractor. All work shall be performed by competent employees during regular working hours of regular working days. This service shall not cover adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents caused by persons other than the elevator contractor. Only genuine parts and supplies as used in the manufacture and installation of the original equipment shall be provided.

B. The elevator control system must:

C. 1) Provide in the controller the necessary devices to run the elevator on inspection operation.

D. 2) Provide on top of the car the necessary devices to run the elevator in inspection operation.

E. 3) Provide in the controller an emergency stop switch. This emergency stop switch when opened disconnects power from the brake and prevents the motor from running.

F. Provide system capabilities to enable a remote expert to create a live, interactive connection with the elevator system to enable the following functions:
1. Remotely diagnose elevator issues with a remote team of experts
2. Remotely return an elevator to service
3. Provide real-time status updates via email

4. Remotely make changes to selected elevator functions including:
    a. Control building traffic: Restrict floor access, remove car from group operation, shut down elevator, select up peak / down peak mode, activate independent service
    b. Conserve energy: Activate cab light energy save mode, activate fan energy save mode, shut down car(s)
    c. Improve passenger experience: Extend door open times, change parking floor, activate auto car full, activate anti-nuisance, advance door opening, door nudging, extend specific floor extended opening time, release trapped passengers

PART 2 - PRODUCTS

2.01 BASIS-OF-DESIGN

A. Otis HydroFit, machine-roomless, holeless, hydraulic elevator.

2.02 AVAILABLE MANUFACTURERS

A. Subject to compliance with the requirements of the specifications products from the following manufacturers may be provided:
    1. Otis Elevator Company.
    2. Schindler Elevator Corporation.
    3. ThyssenKrupp Elevator.
    4. Non-Proprietary Manufacture to be submitted during bid for approval.
    5. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 DESIGN AND SPECIFICATIONS

A. Provide machine-roomless holeless hydraulic elevators. The system shall consist of the following components:
    1. The entire hydraulic system and the controller shall be located inside the hoistway. No extra machine room or control closet space is required.
    2. Sleep mode operation for LED ceiling lights and car fan.
    3. LED lighting standard in ceiling lights and elevator fixtures.
    4. 4. Sleep mode operation for LED ceiling lights and car fan.

2.04 EQUIPMENT: MACHINE COMPONENTS

A. The hydraulic system shall be of compact design suitable for operation under the required pressure. The power component shall be mounted in the hydraulic-fluid storage tank. The control valve shall control flow for up and down directions hydraulically and shall include an integral check valve. A control section including control solenoids shall direct the main valve and control: up and down starting, acceleration, transition from full speed to leveling speed, up and down stops, pressure relief and manual lowering. All of these functions shall be fully adjustable for maximum smoothness and to meet contract conditions. System to be provided with a low-pressure switch and a shut-off valve.
    1. The entire hydraulic system with hydraulic-fluid storage tank, power component and valves shall be located in the hoistway pit and be easily accessible for maintenance through an access door in the hoistway wall.

B. A microprocessor-based controller shall be provided, including necessary starting switches together with all relays, switches, solid-state components and hardware required for operation, including door operation, as described herein. A three (3) phase overload device shall be provided to protect the motor against overloading.
    1. The controller shall be located together with the hydraulic system in the hoistway pit and be easily accessible for maintenance through the same access door that is also used for the hydraulic system.

C. A manual lowering feature shall permit lowering the elevator at slow speed in the event of power failure or for adjusting purposes.

D. Pressure Switch

2.05 EQUIPMENT: HOISTWAY COMPONENTS

A. Plunger(s) and Cylinder(s): Each cylinder shall be constructed of steel pipe of sufficient thickness and suitable for the operating pressure. The top of each cylinder shall be equipped with a cylinder head with a drip ring to collect any oil seepage as well as an internal guide ring and self-adjusting packing. Each plunger shall be constructed of selected steel tubing or pipe of proper diameter machined true and smooth with a fine polished finish. Each plunger shall be provided with a stop ring electrically welded to it to prevent the plunger from leaving the cylinder. Each plunger and cylinder shall be installed plumb and shall operate freely with minimum friction.

B. Car Guide Rails: Tee-section steel rails with brackets and fasteners.

C. Polyurethane type buffers shall be used.

D. Wiring: Wiring for hoistway electrical devices included in scope of the elevator system, hall panels, pit emergency stop switch, and the traveling cable for the elevator car.

E. Hoistway Entrances:
   1. Frames: Entrance frames shall be of bolted construction for complete one-piece unit assembly. All frames shall be securely fastened to fixing angles mounted in the hoistway and shall be of UL fire rated steel.
   2. Sills shall be extruded aluminum or bronze finish, or nickel silver finish.
   3. Doors: Entrance doors shall be of metal construction with vertical channel reinforcements.
   4. Fire Rating: Entrance and doors shall be UL fire rated for 1-1/2 hour
   5. Entrance Finish: satin stainless steel
   6. Entrance marking plates: Entrance jambs shall be marked with 4” x 4” (102 mm x 102 mm) plates having raised floor markings with Braille located adjacent to the floor marking. Marking plates shall be provided on both sides of the entrance.
   7. Sight Guards: sight guards will be furnished with all doors painted to match with painted doors, painted black for stainless steel and gold satin doors.

F. Fascia: Galvanized sheet steel shall be provided at the front of the hoistway

2.06 EQUIPMENT: CAR COMPONENTS

A. Cab: Steel Shell Cab with laminated vertical panels.

B. Paints and laminate to be selected from manufacturer’s catalog of choices.

C. Brushed Stainless Steel finished base plate located at top and bottom

D. Car Front Finish: Satin Stainless Steel.

E. Car Door Finish: Satin Stainless Steel.

F. Ceiling Type: Satin Stainless Stee with 6 LED lights.

G. Emergency Car Lighting: An emergency power unit employing a 6-volt sealed rechargeable battery and totally static circuits shall be provided to illuminate the elevator car in the event of building power failure.

H. Fan: A one-speed 120 VAC fan will be mounted to the structural ceiling to facilitate in-car air circulation, meeting A17.1 code requirements. The fan shall be rubber mounted to prevent the transmission of structural vibration and will include a baffle to diffuse audible noise. A switch shall be provided in the car-operating panel to control the fan.

I. Handrail: Handrails shall be provided on the side and rear walls of the car enclosure. Handrails shall be 1 ½” diameter Round bar handrail with a Brushed Steel.

J. Threshold: Extruded Aluminum or Bronze Finish or Nickel-Silver Finish.

K. Emergency Exit Contact: An electrical contact shall be provided on the car-top exit.

L. Guides: Car roller type guides at the top and the bottom.

M. Platform: Car platform shall be constructed of metal.

N. Certificate frame: Provide a Certificate frame with a satin stainless steel finish.

O. The LED ceiling lights and the fan should automatically shut off when the system is not in use and be powered back up after a passenger calls the elevator and pushes a hall button.

2.07 EQUIPMENT: SIGNAL DEVICES AND FIXTURES

A. Car Operating Panel: A car operating panel shall be provided which contains all push buttons, key switches, and message indicators for elevator operation. The car operating panel shall have a satin stainless steel finish.

B. A car operating panel shall be furnished. It shall contain a bank of round stainless steel, mechanical LED illuminated buttons. Flush mounted to the panel and marked to correspond to the landings served. All buttons to have raised numerals and Braille markings with:

C. Vandal-Resistant, Flush satin stainless steel button with blue LED illuminating center jewel

D. The car operating panel shall be equipped with the following features:
   1. 1. Raised markings and Braille to the left hand side of each push-button.
   2. 2. Car Position Indicator at the top of and integral to the car operating panel.
   3. 3. Door open and door close buttons.
   4. 4. Inspection key-switch.
   5. 5. Elevator Data Plate marked with elevator capacity and car number.
   6. 6. Help Button: The help button shall initiate two-way communication between the car and a location inside the building, switching over to another location if the call is unanswered, where personnel are available who can take the appropriate action. Visual indicators are provided for call initiation and call acknowledgement.
   7. 7. Landing Passing Signal: A chime bell shall sound in the car to signal that the car is either stopping at or passing a floor served by the elevator.
   8. 8. In car stop switch (toggle or key unless local code prohibits use)
   9. 9. Firefighter's hat
   10. 10. Firefighter's Phase II Key-switch
   11. 11. Call Cancel Button
   12. 12. Firefighter's Phase II Emergency In-Car Operating Instructions: worded according to A17.1 2000, Article 2.27.7.2.

E. Car Position Indicator: A digital, LED car position indicator shall be integral to the car operating panel.

F. Hall Fixtures: Hall fixtures shall be provided with necessary push buttons and key switches for elevator operation. Integral Hall fixtures shall feature round stainless steel, mechanical buttons marked to correspond to the landings. Hall fixtures to be located in the entrance frame face or the wall. Buttons shall be in vertically mounted fixture. Fixture shall be satin stainless steel finish.

G. Vandal-Resistant, Flush satin stainless steel button with blue LED illuminating center jewel

H. Car Lantern and Chime: A directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and a chime will sound.

I. Access key-switch at lowest floor in entrance jamb.

2.08 ACCESS CONTROL

A. Coordinate elevator function with access control via the following methods.
   1. Card reader access at first floor and second floor landings.
      a. Elevator Contractor shell secure parts and services directly from Security Instrument Corp to provide access control features.
         1) Please contact Security Instrument (Larry Echols @ 302-605-0487) for pricing related to this addition.
         2) Access Control Description:

2.09 CALL BUTTONS MUST BE IN A DISABLED STATE NORMALLY.

A. Access Control reader on Level 1 and Level 2 shall be provided adjacent to call button.

B. When reader is activated, the call button will become active for the duration programmed in the access control system. This may be accomplished by either method listed below depending on the elevator equipment/capabilities.

C. Disable the call button directly by including a relay that would be mounted behind the call button in Normally Open mode to break one side of the call button. Activating the relay would close the circuit and allow the button to function.

D. Relays would be mounted and connected to Inputs at the elevator controller. When a relay is activated, the associated call button would be programmed to be enabled for the duration that the input remains active (shorted).

E. The Access Control system will require readers, relays, and additional control board with enclosure, programming, testing, etc.

F. Keyed access at first floor and second floor landings.

G. Keyed access integrated with hall call buttons.

PART 3 - EXECUTION

3.01 PREPARATION

A. Take field dimensions and examine conditions of substrates, supports, and other conditions under which this work is to be performed. Do not proceed with work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Installation of all elevator components except as specifically provided for elsewhere by others.

3.03 DEMONSTRATION

A. The elevator contractor shall make a final check of each elevator operation with the Owner or Owner's representative present prior to turning each elevator over for use. The elevator contractor shall determine that control systems and operating devices are functioning properly.

END OF SECTION 14 24 00

SECTION 21 05 00

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Above ground piping.

B. Pipe, fittings, valves, and connections for sprinkler, standpipe and fire hose, and combination sprinkler and standpipe systems.

C. Pipe hangers and supports.

1.02 RELATED REQUIREMENTS

A. Section 09 90 00 - Painting and Coating: Preparation and painting of fire protection piping systems.

B. Section 21 05 53 - Identification for Fire Supp. Piping and Equipment: Piping identification.

1.03 REFERENCE STANDARDS

A. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fuzing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications.

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300.

D. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250.

E. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard.

F. ASME B16.9 - Factory-Made Wrought Buttwelding Fittings.

G. ASME B16.11 - Forged Fittings, Socket-welding and Threaded.

H. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

I. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

J. ASME B16.25 - Buttwelding Ends.

K. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.

L. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.

M. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

N. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe.

O. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

P. ASTM A536 - Standard Specification for Ductile Iron Castings.

Q. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.

R. ASTM B32 - Standard Specification for Solder Metal.

S. ASTM B75/B75M - Standard Specification for Seamless Copper Tube.

T. ASTM B75M - Standard Specification for Seamless Copper Tube (Metric).

U. ASTM B88 - Standard Specification for Seamless Copper Water Tube.

V. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric).

W. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.

X. ASTM F439 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

Y. ASTM F442/F442M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).

Z. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

AA. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

AB. AWS D1.1/D1.1M - Structural Welding Code - Steel.

AC. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems.

AD. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings.

AE. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

AF. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast.

AG. NFPA 13 - Standard for the Installation of Sprinkler Systems.

AH. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.

AI. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances; National Fire Protection Association; 1995.

AJ. UL (DIR) - Online Certifications Directory.

AK. UL 262 - Gate Valves for Fire-Protection Service; Underwriters Laboratories Inc..

AL. UL 312 - Check Valves for Fire-Protection Service; Underwriters Laboratories Inc..

1.04 SUBMITTALS

A. Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.

B. Project Record Documents: Record actual locations of components and tag numbering.

C. Operation and Maintenance Data: Include installation instructions and spare parts lists.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years experience. approved by manufacturer.

C. Conform to UL requirements.

D. Valves: Bear UL label or marking. Provide manufacturer's name and pressure rating marked on valve body.

E. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

PART 2 PRODUCTS

2.01 FIRE PROTECTION SYSTEMS

A. Sprinkler Systems: Conform work to NFPA 13.
   1. Comply with NFPA 13.

B. Standpipe and Hose Systems: Conform to NFPA 14.
   1. Comply with NFPA 14.

C. Welding Materials and Procedures: Conform to ASME Code.

D. Provide system pipes, fittings, sleeves, escutcheons, seals, and other related accessories.

2.02 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A795 Schedule 10 or ASTM A53 Schedule 40, black.
   1. Steel Fittings: ASME B16.9, wrought steel, buttwelded.
   2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings.
   3. Malleable Iron Fittings: ASME B16.3, threaded fittings.
   4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
   5. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), H58 drawn.
   1. Fittings: ASME B16.18, cast copper alloy, grooved.
   2. Mechanical Grooved Couplings: Ductile iron housing with alkyd enamel paint coating clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers.

2.03 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.

C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

D. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

E. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

F. Vertical Support: Steel riser clamp.

G. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

H. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.04 GATE VALVES

A. Up to and including 2 inches:
   1. Bronze body, bronze trim, rising stem, handwheel, solid wedge or disc, threaded ends.

B. Over 2 inches:
   1. Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid rubber covered bronze or cast iron wedge, flanged ends.

C. Over 4 inches:
   1. Iron body, bronze trim, non-rising stem with bolted bonnet, solid bronze wedge, flanged ends, iron body indicator post assembly.

2.05 GLOBE VALVES

A. Up to and including 2 inches:
   1. Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable rubber disc, threaded ends, with backseating capacity repackable under pressure.

B. Over 2 inches:
   1. Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

2.06 BALL VALVES

A. Up to and including 2 inches:
   1. Bronze two piece body, brass, chrome plated bronze, or stainless steel ball, teflon seats and stuffing box ring, lever handle and balancing stops, threaded ends .

B. Over 2 inches:
   1. Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle or gear drive handwheel for sizes 10 inches and over, flanged.

2.07 BUTTERFLY VALVES

A. Bronze Body:
   1. Stainless steel disc, resilient replaceable seat, threaded or grooved ends, extended neck, handwheel and gear drive and integral indicating device, and built-in tamper proof switch rated 10 amp at 115 volt AC.

B. Cast or Ductile Iron Body
   1. Cast or ductile iron, chrome or nickel plated ductile iron or aluminum bronze disc, resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck, handwheel and gear drive and integral indicating device, and internal tamper switch rated 10 amp at 115 volt AC.

2.08 CHECK VALVES

A. Up to and including 2 inches:
   1. Bronze body and swing disc, rubber seat, threaded ends.

B. Over 2 inches:
   1. Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, flanged ends with automatic ball check.

C. 4 inches and Over:
   1. Iron body, bronze disc, stainless steel spring, resilient seal, threaded, wafer, or flanged ends.

2.09 DRAIN VALVES

A. Compression Stop:
   1. Bronze with hose thread nipple and cap.

B. Ball Valve:
   1. Brass with cap and chain, 3/4 inch hose thread.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.

B. Install standpipe piping, hangers, and supports in accordance with NFPA 14.

C. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

D. Install piping to conserve building space, to not interfere with use of space and other work.

E. Group piping whenever practical at common elevations.

F. Sleeve pipes passing through partitions, walls, and floors.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

H. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

I. Pipe Hangers and Supports:
1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
2. Place hangers within 12 inches of each horizontal elbow.
3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
4. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
6. Provide copper plated hangers and supports for copper piping.
7. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

J. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

K. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding. Refer to Section 09 90 00.

L. Do not penetrate building structural members unless indicated.

M. Provide sleeves when penetrating footings, floors, and walls. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.

N. Escutcheons:
1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
3. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.

O. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

P. Die cut threaded joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.

Q. Install valves with stems upright or horizontal, not inverted. Remove protective coatings after installation.

R. Provide gate, ball, or butterfly valves for shut-off or isolating service.

S. Provide drain valves at main shut-off valves, low points of piping and apparatus.

END OF SECTION 21 05 00

SECTION 21 05 53

IDENTIFICATION FOR FIRE SUPP. PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe Markers.

D. Ceiling tacks.

1.02 RELATED REQUIREMENTS

A. Section 09 90 00 - Painting and Coating: Identification painting.

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.04 SUBMITTALS

A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

E. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Instrumentation: Nameplates.

B. Major Control Components: Nameplates.

C. Piping: Pipe markers.

D. Small-sized Equipment: Nameplates.

E. Valves: Nameplates Tags and ceiling tacks where located above accessible ceilngs..

2.02 MANUFACTURERS

A. Brady Corporation: www.bradycorp.com.

B. Champion America, Inc: www.Champion-America.com.

C. Seton Identification Products: www.seton.com/aec.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch.
   3. Background Color: Black.

2.04 TAGS

A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

B. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.05 PIPE MARKERS

A. Color: Conform to ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Color code as follows:
   1. Fire Quenching Fluids: Red with white letters.

2.06 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

B. Color code as follows:
   1. Sprinkler Valves: Red.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Apply stencil painting in accordance with Section 09 90 00.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. Identify pumps and valves with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.

H. Identify control panels and major control components outside panels with plastic nameplates.

I. Identify thermostats relating to terminal boxes or valves with nameplates.

J. Identify valves in main and branch piping with tags.

K. Tag automatic controls, instruments, and relays. Key to control schematic.

L. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

M. Locate ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 21 05 53

SECTION 21 13 00
FIRE SUPPRESSION SPRINKLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wet-pipe sprinkler system.

B. System design, installation, and certification.

1.02 RELATED REQUIREMENTS

A. Section 28 46 00 - Fire Detection and Alarm.

B. Section 21 05 00 - Common Work Results for Fire Suppression: Pipe, fittings, and valves.

C. Section 21 05 48 - Vibration and Seismic Controls for Fire Suppression Piping and Equipment.

D. Section 21 05 53 - Identification for Fire Supp. Piping and Equipment.

E. Section 21 30 00 - Fire Pumps.

F. Section 21 12 00 - Fire-Suppression Standpipes.

G. Section 14 91 00 - Facility Chutes: Sprinkler heads inside chutes.

H. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

I. Section 22 05 53 - Identification for Plumbing Piping and Equipment.

J. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. FM P7825 - Approval Guide; Factory Mutual Research Corporation.

B. ITS (DIR) - Directory of Listed Products.

C. NFPA 13 - Standard for the Installation of Sprinkler Systems.

D. UL (DIR) - Online Certifications Directory.

1.04 SUBMITTALS

A. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

B. Shop Drawings:
   1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
   2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.
   3. Submit shop drawings and hydraulic calculations to authority having jurisdiction and Fire Marshall for approval. Submit proof of approval to Architect.

C. Samples: Submit one of each style of sprinkler specified.

D. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

E. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.

F. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

G. Maintenance Materials: Furnish the following for North Providence School Department's use in maintenance of project.
   1. Extra Sprinklers: Type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
   2. Sprinkler Wrenches: For each sprinkler type.

1.05 QUALITY ASSURANCE

A. Maintain one copy of referenced design and installation standard on site.

B. Conform to UL requirements.

C. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in Rhode Island.

D. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

E. Installer Qualifications: Company specializing in performing the work of this section with minimum three years experience approved by manufacturer.

F. Equipment and Components: Provide products that bear UL label or marking.

G. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.06 MOCK-UP

A. Provide components for installation in mock-up.

B. Mock-up may not remain as part of the Work.

1.07 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this section.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.09 EXTRA MATERIALS

A. Provide extra sprinklers of type and size matching those installed, in quantity required by referenced NFPA design and installation standard.

B. Provide suitable wrenches for each sprinkler type.

C. Provide metal storage cabinet located adjacent to alarm valve.

PART 2 PRODUCTS

2.01 SPRINKLER SYSTEM

A. Sprinkler System: Provide coverage for building areas noted.

B. Occupancy: comply with NFPA 13.

C. Water Supply: Determine volume and pressure from water flow test data.
   1. Revise design when test data available prior to submittals.

D. Interface system with building fire and smoke alarm system.

E. Provide fire department connections where indicated.

F. Any valves with supervisory switch (tamper or flow) are to be connected to fire alarm control panel with new monitoring module.

G. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

2.02 SPRINKLERS

A. Suspended Ceiling Type: Recessed-type with push on, clamp, or screw type escutcheon plates with 36" flexible braided hose.
   1. Finish: Enamel, color to be selected by architect from standard color chart..
      a. Within Standard Acoustical Tile Ceilings: White sprinkler with white escutcheon plate.
      b. Within Hard Ceiling Surface (Gypsum or Plaster): Custom color sprinkler with custom color escutcheon plate to match ceiling finish.
   2. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

B. Exposed Area Type: Standard upright type with guard.
   1. Finish: Chrome plated.
   2. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

C. Sidewall Type: Standard, Semi-recessed or Recessed horizontal sidewall type with matching push on escutcheon plate and guard.
   1. Finish: Chrome plated.
   2. Escutcheon Plate Finish: Chrome plated.
   3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

D. Dry Sprinklers: Standard, Recessed or Exposed pendant type with matching push on escutcheon plate.
   1. Finish: Chrome plated.
   2. Escutcheon Plate Finish: Chrome plated.
   3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

E. Guards: Finish to match sprinkler finish.

F. Spray Nozzles: Brass with solid cone discharge, 30 degrees of arc with blow-off dust cap.

2.03 PIPING SPECIALTIES

A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm and electric alarm, with pressure retard chamber and variable pressure trim; with test and drain valve.

B. Flooding Deluge Valve: Gate type valve with rubber faced disc actuated manually with water motor alarm and electric alarm, with alarm testing trim.

C. Water Motor Alarm: Hydraulically operated impeller type alarm with aluminum alloy chrome plated gong and motor housing, nylon bearings, and inlet strainer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard.

B. Install equipment in accordance with manufacturer's instructions.

C. Place pipe runs to minimize obstruction to other work.

D. Place piping in concealed spaces above finished ceilings.

E. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.

F. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.

G. Install and connect to fire pump system in accordance with Section 21 30 00.

H. Flush entire piping system of foreign matter.

I. All new sprinkler heads are to be provided within the area of work.

J. Drain existing fire protection loop to extent as required to modify existing sprinkler system, and refill system(s) once work is complete. Install isolation valve(s) with monitoring module and connection to existing fire alarm control panel as needed to maintain fire protection coverage as work is to be performed.

K. Install guards on sprinklers where indicated.

L. Hydrostatically test entire system.

M. Require test be witnessed by Fire Marshal and authority having jurisdiction.

3.02 INTERFACE WITH OTHER PRODUCTS

A. Ensure required devices are installed and connected as required to fire alarm system.

END OF SECTION 21 13 00

SECTION 22 05 16

EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible pipe connectors.

B. Expansion joints and compensators.

C. Pipe loops, offsets, and swing joints.

1.02 RELATED REQUIREMENTS

A. Section 21 05 00 - Common Work Results for Fire Suppression.

B. Section 22 10 05 - Plumbing Piping.

1.03 REFERENCE STANDARDS

A. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

B. EJMA (STDS) - EJMA Standards.

1.04 SUBMITTALS

A. Product Data:

1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

B. Design Data: Indicate selection calculations.

C. Manufacturer's Instructions: Indicate manufacturer's installation instructions, special procedures, and external controls.

D. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.

E. Maintenance Data: Include adjustment instructions.

1.05 REGULATORY REQUIREMENTS

A. Conform to UL or Warnock Hersey requirements.

1.06 EXTRA MATERIALS

A. Supply two sets of packing for each packed expansion joint.

PART 2 PRODUCTS

2.01 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

A. Manufacturers:

1. Mercer Rubber Company: www.mercer-rubber.com/#sle.
2. Metraflex Company: www.metraflex.com/#sle.
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Inner Hose: Carbon Steel, Stainless Steel or Bronze.

C. Exterior Sleeve: Single braided or Double braided, stainless steel or bronze.

D. Exterior Sleeve: None.

E. Pressure Rating: 125 psi and 450 degrees F or 200 psi and 250 degrees F.

F. Joint: As specified for pipe joints.

G. Size: Use pipe sized units.

H. Maximum offset: 3/4 inch on each side of installed center line.

2.02 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

A. Manufacturer:
   1. Mercer Rubber Company: www.mercer-rubber.com/#sle.
   2. Metraflex Company: www.metraflex.com/#sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Inner Hose: Bronze.

C. Exterior Sleeve: Braided bronze.

D. Pressure Rating: 125 psi and 450 degrees F or 200 psi and 250 degrees F.

E. Joint: As specified for pipe joints.

F. Size: Use pipe sized units.

G. Maximum offset: 3/4 inch on each side of installed center line.

H. Application: Copper piping.

2.03 EXPANSION JOINTS - STEEL WITH PACKED SLIDING SLEEVE

A. Working Pressure and Temperature: Class 150 or Class 300.

B. Joint: As specified for pipe joints.

C. Size: Use pipe sized units.

D. Application: Steel piping 2 inches and over.

2.04 EXPANSION JOINTS - COPPER WITH PACKED SLIDING SLEEVE

A. Working Pressure: 125 psi.

B. Maximum Temperature: 250 degrees F.

C. Joint: As specified for pipe joints.

D. Size: Use pipe sized units.

E. Application: Copper or steel piping 2 inches and over.

2.05 ACCESSORIES

A. Stainless Steel Pipe: ASTM A269.

B. Pipe Alignment Guides:
   1. Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inches travel.

C. Swivel Joints:
   1. Fabricated steel, Bronze, Ductile Iron or Cast steel body, double ball bearing race, field lubricated, with rubber (Buna-N) o-ring seals.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.

C. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.

D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

E. Anchor pipe to building structure where indicated. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.

F. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

G. Substitute grooved piping for vibration isolated equipment instead of flexible connectors. Grooved piping need not be anchored.

END OF SECTION 22 05 16

SECTION 22 05 19

METERS AND GAGES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Positive displacement meters.

B. Pressure gages and pressure gage taps.

C. Thermometers and thermometer wells.

D. Static pressure gages.

E. Filter gages.

1.02 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments.

B. ASME MFC-3M - Measurement of Fluid Flow in Pipes Using Orifice, Nozzle and Venturi.

C. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers.

D. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.

E. AWWA C700 - Cold-Water Meters -- Displacement Type, Metal Alloy Main Case.

F. AWWA C701 - Cold-Water Meters -- Turbine Type, for Customer Service.

G. AWWA C702 - Cold-Water Meters -- Compound Type.

H. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold Water Meters; American Water Works Association (ANSI/AWWA C706).

I. AWWA M6 - Water Meters -- Selection, Installation, Testing, and Maintenance.

J. UL 393 - Indicating Pressure Gauges for Fire-Protection Service.

1.03 SUBMITTALS

A. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

B. Project Record Documents: Record actual locations of components and instrumentation.

C. Operation and Maintenance Data: .

1.04 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

1.05 EXTRA MATERIALS

A. Supply two bottles of red gage oil for static pressure gages.

B. Supply two pressure gages with pulsation damper or dial thermometers.

PART 2 PRODUCTS

2.01 LIQUID FLOW METERS

A. Manufacturers:
   1. Dwyer Instruments, Inc: www.dwyer-inst.com.
   2. Venture Measurement, a Danaher Corporation Company: www.venturemeasurement.com.
   3. Omega Meters: www.omega.com.

B. Description: Totalizing turbine-type flow meter with rate indication and pulse output.
   1. Maximum Working Pressure:
      a. PVC: 150 psi
      b. Carbon Steel: 200 psi
   2. Maximum Temperature:

a. PVC: 49°C (120°F)
b. Carbon Steel: 93°C (200°F)

3. Accuracy: ±1% FS
4. Signal: Squarewave pulse
5. Power :6 to 24 Vdc
6. Materials
   a. Meter Body: PVC or carbon steel
   b. Flanges: Van Stone w/steel backing flange for PVC bodies, 150# ANSI for carbon steel bodies
   c. Turbine Rotor: PVDF
   d. Rotor Shafts: Zirconia ceramic
   e. Bearings: Sapphire journal, ruby ball
7. Display
   a. Power: 11 to 24 Vdc, 20 mA max
   b. Rate: 8-digit autorange
   c. Total: 8-digit, selectable decimal
   d. Memory: Non-volatile (no battery needed)
   e. Pulse Output: 0.1 sec, open collector Analog Option 4 to 20 mA, user-programmable
8. Transmitter
   a. Output: 4 to 20 mA
   b. Loop Power: 12 to 26 Vdc (isolated)
   c. Accuracy: ±1%
   d. Response Time: 3 sec, 95% FS

2.02 PRESSURE GAGES

A. Manufacturers:
   1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
   2. Moeller Instrument Co., Inc: www.moellerinstrument.com/#sle.
   3. Omega Engineering, Inc: www.omega.com/#sle.

B. Pressure Gages: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
   1. Case: Steel with brass bourdon tube.
   2. Size: 4-1/2 inch diameter.
   3. Size: 2 inch diameter.
   4. Mid-Scale Accuracy: One percent.
   5. Scale: Psi.

2.03 PRESSURE GAGE TAPPINGS

A. Gage Cock: Tee or lever handle, brass for maximum 150 psi.

B. Needle Valve: Brass or Stainless Steel, 1/4 inch NPT for minimum 150 psi.

C. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections.

D. Syphon: Steel, Schedule 40, 1/4 inch angle or straight pattern.

2.04 STEM TYPE THERMOMETERS

A. Manufacturers:
   1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
   2. Omega Engineering, Inc: www.omega.com/#sle.
   3. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Thermometers - Fixed Mounting: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish.
   1. Size: 9 inch scale.
   2. Window: Clear Lexan.

3. Size: 9 inch scale.
4. Window: Clear glass or Lexan.
5. Accuracy: 2 percent, per ASTM E77.
6. Calibration: Degrees F.

C. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
1. Size: 9 inch scale.
2. Window: Clear Lexan.
3. Size: 9 inch scale.
4. Window: Clear glass or Lexan.
5. Stem: 3/4 inch NPT brass.
6. Accuracy: 2 percent, per ASTM E77.
7. Calibration: Degrees F.

2.05 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.06 TEST PLUGS

A. Test Plug: 1/4 inch or 1/2 inch brass or stainless steel fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with Nordel core for temperatures up to 350 degrees F.

B. Test Kit: Carrying case, internally padded and fitted containing one 2-1/2 inch diameter pressure gages, one gage adapters with 1/8 inch probes, two 1 inch dial thermometers.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install positive displacement meters with isolating valves on inlet and outlet to AWWA M6. Provide full line size valved bypass with globe valve for liquid service meters.

C. Provide one pressure gage per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gage.

D. Install pressure gages with pulsation dampers. Provide gage cock or needle valve to isolate each gage. Extend nipples and siphons to allow clearance from insulation.

E. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

F. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets. Refer to Section 23 09 43.

G. Coil and conceal excess capillary on remote element instruments.

H. Provide instruments with scale ranges selected according to service with largest appropriate scale.

I. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

J. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

K. Locate test plugs adjacent thermometers and thermometer sockets, adjacent to pressure gages and pressure gage taps, adjacent to control device sockets or where indicated.

3.02 SCHEDULES

A. Positive Displacement Meters, Location:
   1. Domestic cold water.
   2. Expansion tank make-up.

B. Pressure Gages, Location and Scale Range:
   1. Pumps, 0 to 100 psi.
   2. Expansion tanks, 0 to 100 psi.
   3. Sprinkler system, 0 to 100 psi.
   4. Backflow preventers, 0 to 100 psi.

C. Pressure Gage Tappings, Location:
   1. Control valves 3/4 inch & larger - inlets and outlets.
   2. Major coils - inlets and outlets.
   3. Heat exchangers - inlets and outlets.

D. Stem Type Thermometers, Location and Scale Range:
   1. Domestic hot water supply and recirculation, 0 to 220 degrees F.

END OF SECTION 22 05 19

SECTION 22 05 48

VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

SEE SPECIFICATION SECTION 23 05 48

END OF SECTION 22 05 48

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe Markers.

1.02 RELATED REQUIREMENTS

A. Section 09 90 00 - Painting and Coating: Identification painting.

B. Section 22 60 05 - Medical Air, Gas, and Vacuum Systems: Supply of pipe labels for placement under this section.

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers.

1.04 SUBMITTALS

A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Samples: Submit two labels; tags in size.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 PLUMBING COMPONENT IDENTIFICATION GUIDELINE

A. Pipe Markers: 3/4 inch diameter and higher.

2.02 MANUFACTURERS

A. Brady Corporation: www.bradycorp.com.

B. Champion America, Inc: www.Champion-America.com.

C. Seton Identification Products: www.seton.com/aec.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: Black.
   2. Letter Height: 1/2 inch.
   3. Background Color: Yellow.

2.04 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter or square.

B. Metal Tags: Brass, aluminum, or stainless steel with stamped letters; tag size minimum 1-1/2 inch diameter or square with smooth edges.

C. Chart: Typewritten letter size list in anodized aluminum frame.

2.05 STENCILS

A. Stencils: With clean cut symbols and letters of following size:
   1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
   2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
   3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.
   4. 8 to 10 inch Outside Diameter of Insulation or Pipe: 24 inch long color field, 2-1/2 inch high letters.
   5. Over 10 inch Outside Diameter of Insulation or Pipe: 32 inch long color field, 3-1/2 inch high letters.
   6. Ductwork and Equipment: 2-1/2 inch high letters.

B. Stencil Paint: As specified in Section 09 90 00, semi-gloss enamel, colors conforming to ASME A13.1.

2.06 PIPE MARKERS

A. Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.07 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

B. Color code as follows:
   1. HVAC Equipment: Yellow.
   2. Fire Dampers and Smoke Dampers: Red.
   3. Plumbing Valves: Green.
   4. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.02 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Apply stencil painting in accordance with Section 09 90 00.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates or stencil painting. Small devices, such as in-line pumps, may be identified with tags.

H. Identify control panels and major control components outside panels with plastic nameplates.

I. Identify thermostats relating to terminal boxes or valves with nameplates.

J. Identify valves in main and branch piping with tags.

K. Identify air terminal units and radiator valves with numbered tags.

L. Tag automatic controls, instruments, and relays. Key to control schematic.

M. Identify piping, concealed or exposed, with plastic pipe markers or plastic tape pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

N. Identify ductwork with plastic nameplates or stenciled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

O. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 22 05 53

SECTION 22 07 16
PLUMBING EQUIPMENT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible elastomeric cellular insulation.

B. Equipment insulation.

C. Covering.

1.02 RELATED REQUIREMENTS

A. Section 09 90 00 - Painting and Coating: Painting insulation covering.

B. Section 22 05 53 - Identification for Plumbing Piping and Equipment.

C. Section 22 10 05 - Plumbing Piping: Placement of hangers and hanger inserts.

D. Section 23 21 13 - Hydronic Piping: Placement of hangers and hanger inserts.

E. Section 23 21 14 - Hydronic Specialties.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

D. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

E. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.

F. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

G. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type).

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

I. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

J. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association.

K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for equipment scheduled.

B. Samples: Submit two samples of any representative size illustrating each insulation type.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with not less than three years of experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturers:
   1. Knauf Insulation; : www.knaufusa.com.
   2. Johns Manville Corporation; : www.jm.com.
   3. Owens Corning Corp; : www.owenscorning.com/#sle.
   4. CertainTeed Corporation; : www.certainteed.com.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: ASTM C553; flexible, noncombustible.
   1. 'K' Value: 0.36 at 75 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
   2. Maximum Service Temperature: 450 degrees F, 850 degrees F, 1000 degrees F or 1200 degrees F.
   3. Maximum Water Vapor Sorption: 5.0 percent by weight.

C. Vapor Barrier Jacket: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film or Vinyl.
   1. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
   2. Secure with self-sealing longitudinal laps and butt strips.
   3. Secure with outward clinch expanding staples and vapor barrier mastic.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive:
   1. Compatible with insulation.

F. Insulating Cement/Mastic:
   1. ASTM C195; hydraulic setting on mineral wool.

2.03 GLASS FIBER, RIGID

A. Manufacturer:
   1. Knauf Insulation: www.knaufusa.com.
   2. Johns Manville Corporation: www.jm.com.
   3. Owens Corning Corp: www.owenscorning.com/#sle.
   4. CertainTeed Corporation; www.certainteed.com.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: ASTM C612 or ASTM C592; rigid, noncombustible.
   1. 'K' Value: 0.25 at 75 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
   2. Maximum Service Temperature: 850 degrees F or 1200 degrees F.
   3. Maximum Water Vapor Sorption: 5.0 percent by weight.

4. Maximum Density: 8.0 lb/cu ft or 12.0 lb/cu ft.

C. Vapor Barrier Jacket:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film or Vinyl.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with self-sealing longitudinal laps and butt strips.
4. Secure with outward clinch expanding staples and vapor barrier mastic.

D. Facing: 1 inch galvanized steel hexagonal wire mesh stitched on one face of insulation.

E. Vapor Barrier Lap Adhesive:
1. Compatible with insulation.

F. Insulating Cement/Mastic:
1. ASTM C195; hydraulic setting on mineral wool.

2.04 CELLULAR GLASS

A. Manufacturer:
1. Pittsburgh Corning Corporation: www.foamglasinsulation.com/#sle.
2. Substitutions: Contact Behan Brothers, Inc.

B. Insulation: ASTM C552, Grade 2.
1. 'K' Value: 0.41 at 100 degrees F.
2. Service Temperature: Up to 900 degrees F.
3. Water Vapor Permeability: 0.005 perm inch.
4. Water Absorption: 0.2 percent by volume, maximum.
5. Density: Minimum 6.80 lb/cu ft.

2.05 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
1. Armacell International: www.armacell.com/#sle.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C 534 Grade 3, Grad 2 or Grade 1, in sheet form.
1. Minimum Service Temperature: -40 degrees F.
2. Maximum Service Temperature: 220 degrees F.
3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.06 JACKETS

A. PVC Plastic:
1. Manufacturers:
a. Johns Manville Corporation: www.jm.com/#sle.
b. Substitutions: Contact Behan Brothers, Inc.
2. Jacket: Sheet material, off-white color.
a. Minimum Service Temperature: -40 degrees F.
b. Maximum Service Temperature: 150 degrees F.
c. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
d. Thickness: 10 mil.
e. Connections: Brush on welding adhesive or Pressure sensitive color matching vinyl tape.
3. Covering Adhesive Mastic:
a. Compatible with insulation.

B. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.
1. Lagging Adhesive:
a. Compatible with insulation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Factory Insulated Equipment: Do not insulate.

C. Exposed Equipment: Locate insulation and cover seams in least visible locations.

D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

E. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

F. Insulated equipment containing fluids below ambient temperature: Insulate entire system.

G. Fiber glass insulated equipment containing fluids below ambient temperature: Provide vapor barrier jackets, factory-applied or field-applied. Finish with glass cloth and vapor barrier adhesive.

H. For hot equipment containing fluids 140 degrees F or less, do not insulate flanges and unions, but bevel and seal ends of insulation.

I. For hot equipment containing fluids over 140 degrees F, insulate flanges and unions with removable sections and jackets.

J. Fiber glass insulated equipment containing fluids above ambient temperature: Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Finish with glass cloth and adhesive.

K. Inserts and Shields:
   1. Application: Equipment 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel or Steel between hangers and inserts.
   3. Insert location: Between support shield and equipment and under the finish jacket.
   4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

L. Finish insulation at supports, protrusions, and interruptions.

M. Cover glass fiber insulation with metal mesh and finish with heavy coat of insulating cement.

N. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

O. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

3.03 SCHEDULES

A. Equipment: Domestic hot-water storage tanks, heat exchangers, and expansion tanks, not factory insulated.
   1. Operating Temperature: 55 to 140 degrees F.
   2. Insulation Material: Glass Fiber
   3. Insulation Thickness: 2 inch.
   4. Field-Applied Jacket: PVC
   5. Vapor Retarder Required: No
   6. Finish: None.

END OF SECTION 22 07 16

SECTION 22 07 19
PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible elastomeric cellular insulation.

B. Piping insulation.

C. Jackets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 22 10 05 - Plumbing Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

D. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

E. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.

F. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.

G. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

H. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

I. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.

J. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.

K. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

L. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing.

M. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.

N. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

O. ASTM D1056 - Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.

P. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.

Q. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

R. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

S. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association.

T. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Samples: Submit two samples of any representative size illustrating each insulation type.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 3 years of experience, or and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

2.02 GLASS FIBER

A. Manufacturers:
   1. Knauf Insulation: www.knaufusa.com.
   2. Johns Manville Corporation: www.jm.com.
   3. Owens Corning Corp: www.owenscorning.com.
   4. CertainTeed Corporation; : www.certainteed.com.
   5. Substitutions: Contact Behan Brothers, Inc.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. 'K' value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum service temperature: 850 degrees F; 1200 degrees F; 1600 degrees F.
   3. Maximum moisture absorption: 0.2 percent by volume.

C. Insulation: ASTM C547 ; semi-rigid, noncombustible, end grain adhered to jacket.
   1. 'K' value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum service temperature: 650 degrees F.
   3. Maximum moisture absorption: 0.2 percent by volume.

D. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

E. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

F. Vapor Barrier Lap Adhesive:
   1. Compatible with insulation.

G. Insulating Cement/Mastic:
   1. ASTM C195; hydraulic setting on mineral wool.

H. Fibrous Glass Fabric:
   1. Cloth: Untreated; 9 oz/sq yd weight.
   2. Blanket: 1.0 lb/cu ft density.
   3. Weave: 5x5; 10x10; or 10x20.

I. Indoor Vapor Barrier Finish:
   1. Cloth: Untreated; 9 oz/sq yd weight.

2. Vinyl emulsion type acrylic, compatible with insulation, black or white color.

J. Outdoor Vapor Barrier Mastic:
1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

K. Outdoor Breather Mastic:
1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

L. Insulating Cement:
1. ASTM C449/C449M.

2.03 CELLULAR GLASS

A. Manufacturers:
1. Pittsburgh Corning Corporation: www.foamglasinsulation.com/#sle.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: ASTM C552, Grade 1.
1. 'K' value: 0.37 at 100 degrees F.
2. Service Temperature: Up to 900 degrees F.
3. Water Vapor Permeability: 0.005 perm inch.
4. Water Absorption: 0.2 percent by volume, maximum.

2.04 EXPANDED POLYSTYRENE

A. Manufacturers:

B. Insulation: ASTM C578; rigid closed cell.
1. 'K' value: 0.23 at 75 degrees F.
2. Maximum service temperature: 165 degrees F.
3. Maximum water vapor permeance: 5.0 perms

2.05 EXPANDED PERLITE

A. Manufacturers:
1. Schundler Company: www.schundler.com/#sle.

B. Insulation: ASTM C610, molded.
1. Maximum service temperature: 1200 degrees F.
2. Maximum water vapor transmission: 0.1 perm.

2.06 POLYISOCYANURATE CELLULAR PLASTIC

A. Insulation Material: ASTM C591, rigid molded modified polyisocyanurate cellular plastic.
1. Dimension: Comply with requirements of ASTM C585.
2. 'K' value: 0.18 at 75 degrees F, when tested in accordance with ASTM C518.
3. Minimum Service Temperature: -70 degrees F.
4. Maximum Service Temperature: 300 degrees F.
5. Water Absorption: 0.5 percent by volume, maximum, when tested in accordance with ASTM D2842..
6. Moisture Vapor Transmission: 4.0 perm in.
7. Connection: Waterproof vapor barrier adhesive.

2.07 POLYETHYLENE

A. Manufacturers:
1. Armacell International: www.armacell.com/#sle.

B. Insulation: Flexible closed-cell polyethylene tubing, slit lengthwise for installation, complying with applicable requirements of ASTM D1056.
1. 'K' value: ASTM C177; 0.25 at 75 degrees F.
2. Maximum Service Temperature: 200 degrees F.
3. Density: 2 lb/cu ft.
4. Maximum Moisture Absorption: 1.0 percent by volume.
5. Moisture Vapor Permeability: 0.05 perm inch, when tested in accordance with ASTM E96/E96M.

6. Connection: Contact adhesive.

2.08 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   1. Armacell International: www.armacell.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C 534 Grade 3;grade 2; grade 1 use molded tubular material wherever possible.
   1. Minimum Service Temperature: -40 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.09 JACKETS

A. PVC Plastic.
   1. Manufacturers:
      a. Johns Manville Corporation: www.jm.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 20 mil; 30 mil.
      e. Connections: Brush on welding adhesive, tacks, pressure sensitive color matching vinyl tape.
   3. Covering Adhesive Mastic:

B. ABS Plastic:
   1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: -40 degrees F.
      b. Maximum Service Temperature of 180 degrees F.
      c. Moisture Vapor Permeability: 0.012 perm inch, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 30 mil.
      e. Connections: Brush on welding adhesive.

C. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.
   1. Lagging Adhesive:
      a. Compatible with insulation.

D. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
   1. Thickness: 0.016 inch, 0.020 inch sheet.
   2. Finish: Smooth, embossed.
   3. Joining: Longitudinal slip joints and 2 inch laps.
   4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.
   6. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

E. Stainless Steel Jacket: ASTM A 666, Type 304 or 316 stainless steel.
   1. Thickness: 0.010 inch.
   2. Finish: Smooth.
   3. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

G. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

H. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

I. Inserts and Shields:
   1. Application: Piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert location: Between support shield and piping and under the finish jacket.
   4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.

K. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

L. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

M. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

N. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.03 SCHEDULES

3.04 INTERIOR INSULATION APPLICATION SCHEDULE

A. Service: Domestic hot, recirculated hot water.
   1. Operating Temperature: 60 to 140 deg F.
   2. Insulation Material: Flexible elastomeric or glass fiber.
   3. Insulation Thickness: Apply the following insulation thicknesses:
      a. Pipe, All Sizes: 1.0 inch.
   4. Jacket:
      a. Exposed Spaces (mechanical rooms, closets, etc.) = PVC
      b. Concealed Spaces = None
   5. Vapor Retarder Required: No.
   6. Finish: None.

B. Service: Domestic cold water.
   1. Operating Temperature: 35 to 60 deg F.
   2. Insulation Material: Flexible elastomeric or glass fiber.
   3. Insulation Thickness: Apply the following insulation thicknesses:
      a. Pipe, 1" or less: 0.5 inch.
      b. Pipe, 1¼" to 2" : 0.5 inch.
      c. Pipe, 2-1/2" to 4": 1.0 inch.
      d. Pipe, 5" and up : 1.0 inch.
   4. Jacket:
      a. Exposed Spaces (mechanical rooms, closets, etc.) = PVC
      b. Concealed Spaces = None
   5. Vapor Retarder Required: Yes.
   6. Finish: None.

C. Service: Rainwater conductors.
   1. Operating Temperature: 32 to 100 deg F.
   2. Insulation Material: Mineral fiber.
   3. Insulation Thickness: Apply the following insulation thicknesses:
      a. Pipe, 3" and up: 1.0 inch.
   4. Jacket:
      a. Concealed Piping - None
      b. Exposed Piping - PVC
   5. Vapor Retarder Required: Yes.
   6. Finish: None.

D. Service: Roof drain bodies.
   1. Operating Temperature: 32 to 100 deg F.
   2. Insulation Material: Mineral fiber.
   3. Insulation Thickness: 1.0 inch.
   4. Jacket:
      a. Concealed - None
      b. Exposed - PVC
   5. Vapor Retarder Required: Yes.
   6. Finish: None

E. Service: Sanitary waste piping where heat tracing is installed.
   1. Operating Temperature: 35 to 100 deg F.
   2. Insulation Material: Mineral fiber.
   3. Insulation Thickness: Apply the following insulation thicknesses:
      a. Pipe, 3" and up: 1.0 inch.
   4. Jacket: Aluminum.
   5. Vapor Retarder Required: Yes.
   6. Finish: None.

F. Service: Condensate drain piping.
   1. Operating Temperature: 35 to 75 deg F.
   2. Insulation Material: Flexible elastomeric.
   3. Insulation Thickness: 0.5 inch.
   4. Jacket: None.
   5. Vapor Retarder Required: Yes.
   6. Finish: None.

G. Service: Exposed sanitary drains and domestic water supplies and stops for fixtures for the disabled.
   1. Operating Temperature: 35 to 120 deg F.
   2. Insulation Material: Molded closed cell vinyl.
   3. Insulation Thickness: 3/16 inch.
   4. Vapor Retarder Required: No.
   5. Finish: None.

3.05 EXTERIOR INSULATION APPLICATION SCHEDULE

A. This application schedule is for aboveground insulation outside the building. Loose-fill insulation, for belowground piping, is specified in Division 2 piping distribution Sections.

B. Service: Domestic water.
   1. Operating Temperature: 60 to 180 deg F.
   2. Insulation Material: Cellular glass, with jacket
   3. Insulation Thickness: Apply the following insulation thicknesses:
      a. Pipe, 1” or less: 2.0 inch.
      b. Pipe, 1-1/4” and larger: 2.0 inch.
   4. Jacket: Aluminum.
   5. Vapor Retarder Required: No.
   6. Finish: None.

C. Service: Storm water.
   1. Operating Temperature: 32 to 100 deg F.
   2. Insulation Material: Flexible elastomeric.
   3. Insulation Thickness: Apply the following insulation thicknesses:
      a. Pipe, 1-1/4” to 2”: 0.5 inch.
      b. Pipe, 2-1/2” and up: 1.0 inch.
   4. Field-Applied Jacket: Aluminum.
   5. Vapor Retarder Required: Yes.
   6. Finish: None.

END OF SECTION 22 07 19

SECTION 22 10 05
PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for piping systems.
   1. Sanitary sewer.
   2. Domestic water.
   3. Storm water.
   4. Condensate Drain Piping.
   5. Flanges, unions, and couplings.
   6. Pipe hangers and supports.
   7. Ball valves.
   8. Valves.
   9. Flow controls.
   10. Check.
   11. Water pressure reducing valves.
   12. Relief valves.
   13. Strainers.

1.02 RELATED REQUIREMENTS

A. Section 31 23 16 - Excavation.

B. Section 31 23 23 - Fill.

C. Section 31 23 16.13 - Trenching.

D. Section 33 01 10.58 - Disinfection of Water Utility Piping Systems.

E. Section 07 84 00 - Firestopping.

F. Section 08 31 00 - Access Doors and Panels.

G. Section 09 90 00 - Painting and Coating.

H. Section 22 05 16 - Expansion Fittings and Loops for Plumbing Piping.

I. Section 22 05 53 - Identification for Plumbing Piping and Equipment.

J. Section 22 07 19 - Plumbing Piping Insulation.

K. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

L. Section 33 01 10.58 - Disinfection of Water Utility Piping Systems.

1.03 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems.

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300.

D. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250.

E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

F. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

G. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.

H. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.

I. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.

J. ASME B31.1 - Power Piping.

K. ASME B31.2 - Fuel Gas Piping; The American Society of Mechanical Engineers.

L. ASME B31.9 - Building Services Piping.

M. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers.

N. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fuzing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications.

O. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.

P. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

Q. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.

R. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

S. ASTM B32 - Standard Specification for Solder Metal.

T. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.

U. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes.

V. ASTM B68/B68M - Standard Specification for Seamless Copper Tube, Bright Annealed.

W. ASTM B68M - Standard Specification for Seamless Copper Tube, Bright Annealed (Metric).

X. ASTM B75/B75M - Standard Specification for Seamless Copper Tube.

Y. ASTM B75M - Standard Specification for Seamless Copper Tube (Metric).

Z. ASTM B88 - Standard Specification for Seamless Copper Water Tube.

AA. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric).

AB. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

AC. ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes.

AD. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV).

AE. ASTM C4 - Standard Specification for Clay Drain Tile and Perforated Clay Drain Tile.

AF. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.

AG. ASTM C14M - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, Culvert Pipe (Metric).

AH. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

AI. ASTM C76M - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric).

AJ. ASTM C425 - Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings.

AK. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

AL. ASTM C443M - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric).

AM. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

AN. ASTM C700 - Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.

AO. ASTM C1053 - Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications.

AP. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

AQ. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

AR. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.

AS. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

AT. ASTM D2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter; 2003.

AU. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

AV. ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings.

AW. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.

AX. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.

AY. ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.

AZ. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.

BA. ASTM D2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping.

BB. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.

BC. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

BD. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.

BE. ASTM D2846/D2846M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.

BF. ASTM D2855 - Standard Practice for the Two-Step (Primer & Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.

BG. ASTM D2996 - Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.

BH. ASTM D2997 - Standard Specification for Centrifugally Cast "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.

BI. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

BJ. ASTM D3262 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.

BK. ASTM D3517 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe.

BL. ASTM D3754 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer and Industrial Pressure Pipe.

BM. ASTM D3840 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Fittings for Nonpressure Applications.

BN. ASTM F437 - Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

BO. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.

BP. ASTM F439 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

BQ. ASTM F441/F441M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.

BR. ASTM F442/F442M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).

BS. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

BT. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

BU. ASTM F628 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core.

BV. ASTM F679 - Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

BW. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

BX. ASTM F1281 - Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe.

BY. ASTM F1282 - Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe.

BZ. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

CA. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems.

CB. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings.

CC. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

CD. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast.

CE. AWWA C651 - Disinfecting Water Mains.

CF. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution.

CG. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service.

CH. AWWA C950 - Fiberglass Pressure Pipe.

CI. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications.

CJ. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

CK. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

CL. MSS SP-67 - Butterfly Valves.

CM. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc..

CN. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends.

CO. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.

CP. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends.

CQ. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves.

CR. MSS SP-85 - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends.

CS. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc..

CT. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

CU. NFPA 54 - National Fuel Gas Code; National Fire Protection Association.

CV. NFPA 58 - Liquefied Petroleum Gas Code; National Fire Protection Association.

1.04 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

B. Project Record Documents: Record actual locations of valves.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with local standards.
   1. Maintain one copy on project site.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.

D. Welder Qualifications: Certified in accordance with ASME (BPV IX).

E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.06 REGULATORY REQUIREMENTS

A. Perform Work in accordance with local plumbing code.

B. Conform to applicable code for installation of backflow prevention devices.

C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.08 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

1.09 EXTRA MATERIALS

A. Provide two repacking kits for each size valve.

PART 2 PRODUCTS

2.01 SANITARY SEWER PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 service weight.
   1. Fittings: Cast iron.
   2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

B. PVC Pipe: ASTM D 3034 SDR 35. As permitted by code.
   1. Fittings: PVC.
   2. Joints: Push-on, using ASTM F477 elastomeric gaskets.

C. PVC Pipe: ASTM D 2665 or ASTM D 3034. As permitted by code.
   1. Fittings: PVC.

2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.02 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 service weight.
   1. Fittings: Cast iron.
   2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

2.03 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74, service weight.
   1. Fittings: Cast iron.
   2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

C. PVC Pipe: ASTM D1785 Schedule 40, or ASTM D2241 SDR 26 for not less than 150 psi pressure rating.
   1. Fittings: ASTM D2466, PVC.
   2. Joints: Solvent welded, with ASTM D2564 Solvent cement.

2.04 WATER PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Ductile Iron Pipe: AWWA C151/A21.51.
   1. Fittings: AWWA C110, ductile or gray iron, standard thickness.
   2. Joints: AWWA C111/A21.11, rubber gasket with 3/4 inch diameter rods.

B. Copper Pipe: ASTM B42, hard drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
   2. Joints: ASTM B 32, alloy Sn95 solder.

C. Copper Pipe: ASTM B42, annealed.
   1. Fittings: ASME B16.26, cast bronze.
   2. Joints: Flared.

2.05 WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Pipe: ASTM B42, hard drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
   2. Joints: ASTM B 32, alloy Sn95 solder.

B. Copper Pipe: ASTM B42, annealed.
   1. Fittings: ASME B16.26, cast bronze.
   2. Joints: Flared.

2.06 WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B32, alloy Sn95 solder.

2.07 STORM WATER PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 service weight.
   1. Fittings: Cast iron.
   2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

B. Concrete Pipe: Nonreinforced, ASTM C14 (ASTM C14M) Class 1.
   1. Fittings: Concrete, as specified for pipe.
   2. Joints: Elastomeric gaskets; ASTM C443 (ASTM C443M).

C. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.08 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 service weight.
   1. Fittings: Cast iron.
   2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

C. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.09 STORM WATER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74 service weight.
   1. Fittings: Cast iron.
   2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

C. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.10 CONDENSATE DRAIN PIPING

A. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.11 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.
   2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 Inch:
   1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
   2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Grooved and Shouldered Pipe End Couplings:
   1. Housing: Malleable iron clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion; steel bolts, nuts, and washers; galvanized for galvanized pipe.
   2. Sealing gasket: "C" shape composition sealing gasket.

D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.12 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.

4. Vertical Pipe Support: Steel riser clamp.

B. Plumbing Piping - Drain, Waste, and Vent:
   1. Conform to ASME B31.9.
   2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
   3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
   6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
   7. Vertical Support: Steel riser clamp.
   8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Plumbing Piping - Water:
   1. Conform to ASME B31.9.
   2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
   3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   4. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.
   5. Hangers for Hot Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron pipe roll, double hanger.
   6. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
   7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded supports or spacers and hanger rods, cast iron roll.
   8. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
   9. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
   10. Wall Support for Hot Pipe Sizes 6 Inches and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron pipe roll.
   11. Vertical Support: Steel riser clamp.
   12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   13. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
   14. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron pipe roll and stand, steel screws, and concrete pier or steel support.
   15. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.13 GATE VALVES

A. Manufacturers:
   1. Conbraco Industries: www.conbraco.com.
   2. Nibco, Inc: www.nibco.com.
   3. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Up To and Including 3 Inches:
   1. 1, Class 125, bronze body, bronze trim, rising stem, handwheel, inside screw, solid wedge disc, solder ends.

C. 2 Inches and Larger:
   1. 1, Class 125, iron body, bronze trim, outside screw and yoke, handwheel, solid wedge disc, flanged ends. Provide chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.14 GLOBE VALVES

A. Manufacturers:
   1. Conbraco Industries: www.conbraco.com.
   2. Nibco, Inc: www.nibco.com.
   3. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Up To and Including 3 Inches:
   1. 1, Class 125, bronze body, bronze trim, handwheel, bronze disc, solder ends.

C. 2 Inches and Larger:
   1. 1, Class 125, iron body, bronze trim, handwheel, outside screw and yoke, renewable bronze plug-type disc, renewable seat, flanged ends. Provide chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.15 BALL VALVES

A. Manufacturers:
   1. Conbraco Industries: www.conbraco.com.
   2. Nibco, Inc: www.nibco.com.
   3. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union.

C. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder ends with union.

2.16 PLUG VALVES

A. Manufacturers:
   1. Conbraco Industries: www.conbraco.com.
   2. Nibco, Inc: www.nibco.com.
   3. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Construction 2-1/2 Inches and Larger: 1, 175 psi CWP, cast iron body and plug, pressure lubricated, teflon or Buna N packing, flanged or grooved ends. Provide lever operator with set screw.

2.17 BUTTERFLY VALVES

A. Manufacturers:
   1. Hammond Valve: www.hammondvalve.com.
   2. Crane Co.: www.cranevalve.com.
   3. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Construction 1-1/2 Inches and Larger: MSS SP-67, 200 psi CWP, cast or ductile iron body, nickel-plated ductile iron disc, resilient replaceable EPDM, Buna N, or EPT seat, wafer, lug, or grooved ends, extended neck, 10 position lever handle.

C. Provide gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.

2.18 FLOW CONTROLS

A. Manufacturers:
   1. ITT Bell & Gossett: www.bellgossett.com.
   2. Griswold Controls: www.griswoldcontrols.com.
   3. Taco, Inc: www.taco-hvac.com.

B. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.

C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi psi.

2.19 SWING CHECK VALVES

A. Manufacturers:
   1. Hammond Valve: www.hammondvalve.com.
   2. Nibco, Inc: www.nibco.com.
   3. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Up to 3 Inches:
   1. 1, Class 125, bronze body and cap, bronze swing disc with rubber seat, solder ends.

C. Over 3 Inches:
   1. 1, Class 125, iron body, bronze swing disc, renewable disc seal and seat, flanged or grooved ends.

2.20 SPRING LOADED CHECK VALVES

A. Manufacturers:
   1. Hammond Valve: www.hammondvalve.com.
   2. Crane Co.: www.cranevalve.com.
   3. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Class 125, iron body, bronze trim, stainless steel springs, bronze disc, Buna N seals, wafer style ends.

2.21 WATER PRESSURE REDUCING VALVES

A. Manufacturers:
   1. Amtrol Inc: www.amtrol.com/#sle.
   2. Cla-Val Co: www.cla-val.com/#sle.
   3. Watts Regulator Company: www.wattsregulator.com/#sle.

B. Up to 2 Inches:
   1. MSS SP-80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single or double union ends.

C. Over 2 Inches:
   1. MSS SP-85, cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.22 RELIEF VALVES

2.23 STRAINERS

2.24 RELIEF VALVES

A. Pressure Relief:
   1. Manufacturers:
      a. Cla-Val Co: www.cla-val.com.
      b. Henry Technologies: www.henrytech.com.
      c. Watts Regulator Company: www.wattsregulator.com.
   2. AGA Z21.22 certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

B. Temperature and Pressure Relief:
   1. Manufacturers:
      a. Cla-Val Co: www.cla-val.com.
      b. Henry Technologies: www.henrytech.com.
      c. Watts Regulator Company: www.wattsregulator.com.
   2. AGA Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME (BPV IV) certified and labelled.

2.25 STRAINERS

A. Manufacturers:
   1. Armstrong International, Inc: www.armstronginternational.com.
   2. Green Country Filter Manufacturing: www.greencountryfilter.com.
   3. WEAMCO: www.weamco.com.

B. Size 2 inch and Under:
   1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
   2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

C. Size 1-1/2 inch to 4 inch:
   1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

D. Size 5 inch and Larger:
   1. Class 125, flanged iron body, basket pattern with 1/8 inch stainless steel perforated screen.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 05 16.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 19.

H. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 31 00.

I. Establish elevations of buried piping outside the building to ensure not less than 3 ft of cover.

J. Install vent piping penetrating roofed areas to maintain integrity of roof assembly .

K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

L. Provide support for utility meters in accordance with requirements of utility companies.

M. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 90 00.

N. Excavate in accordance with Section 31 23 16.

O. Backfill in accordance with Section 31 23 23.

P. Install bell and spigot pipe with bell end upstream.

Q. Install valves with stems upright or horizontal, not inverted.

R. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.

S. Install water piping to ASME B31.9.

T. Install fuel oil piping to ASME B31.9.

U. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

V. Sleeve pipes passing through partitions, walls and floors.

W. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

X. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.
   2. Support horizontal piping as scheduled.
   3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow.
   5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
   7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   8. Provide copper plated hangers and supports for copper piping.
   9. Prime coat exposed steel hangers and supports. Refer to Section 09 90 00. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
   10. Provide hangers adjacent to motor driven equipment with vibration isolation; refer to Section 22 05 48.
   11. Support cast iron drainage piping at every joint.

3.04 APPLICATION

A. Use grooved mechanical couplings and fasteners only in accessible locations.

B. Install unions downstream of valves and at equipment or apparatus connections.

C. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

D. Install gate or ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

E. Install globe valves for throttling, bypass, or manual flow control services.

F. Provide lug end butterfly valves adjacent to equipment when provided to isolate equipment.

G. Provide spring loaded check valves on discharge of water pumps.

H. Provide plug valves in natural gas systems for shut-off service.

I. Provide flow controls in water recirculating systems where indicated.

3.05 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.

B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect water distribution system in accordance with Section 33 01 10.58.

B. Prior to starting work, verify system is complete, flushed and clean.

C. Ensure Ph of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

D. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

E. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

F. Maintain disinfectant in system for 24 hours.

G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

H. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

I. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.07 SERVICE CONNECTIONS

A. Provide new sanitary and storm sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves, pressure reducing valve.
   1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Calk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.
   2. Provide 18 gage galvanized sheet metal sleeve around service main to 6 inch above floor and 6 feet minimum below grade. Size for minimum of 2 inches of loose batt insulation stuffing.

C. Provide new gas service complete with gas meter and regulators. Gas service distribution piping to have initial minimum pressure of 7 inch wg. Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.

3.08 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe size: 1/2 inches to 1-1/4 inches:
         1) Maximum hanger spacing: 6.5 ft.
         2) Hanger rod diameter: 3/8 inches.
      b. Pipe size: 1-1/2 inches to 2 inches:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 3/8 inch.
      c. Pipe size: 2-1/2 inches to 3 inches:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 1/2 inch.
      d. Pipe size: 4 inches to 6 inches:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 5/8 inch.
      e. Pipe size: 8 inches to 12 inches:
         1) Maximum hanger spacing: 14 ft.
         2) Hanger rod diameter: 7/8 inch.
      f. Pipe size: 14 inches and Over:

1) Maximum hanger spacing: 20 ft.
2) Hanger rod diameter: 1 inch.

2. Plastic Piping:
   a. Pipe Size 1" to 6":
      1) Maximum hanger spacing: 6 ft.
      2) Hanger rod diameter: 3/8 inch.
   b. Pipe Size 8" and Over:
      1) Maximum hanger spacing: 6 ft.
      2) Hanger rod diameter: 7/8 inch.

END OF SECTION 22 10 05

SECTION 22 10 06
PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof and floor drains.

B. Cleanouts.

C. Hydrants.

D. Backflow preventers.

E. Water hammer arrestors.

F. Interceptors.

G. Thermostatic mixing valves.

H. Catch basins and manholes.

1.02 RELATED REQUIREMENTS

A. Section 33 05 61 - Concrete Manholes.

B. Section 03 30 00 - Cast-in-Place Concrete: Manhole bottoms.

C. Section 22 10 05 - Plumbing Piping.

D. Section 22 40 00 - Plumbing Fixtures.

E. Section 22 30 00 - Plumbing Equipment.

F. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor and Trench Drains.

B. ASME A112.6.4 - Roof, Deck, and Balcony Drains.

C. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers.

D. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent.

E. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers.

F. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance.

G. ASTM C478 - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections.

H. ASTM C478M - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections (Metric).

I. PDI-WH 201 - Water Hammer Arresters.

1.04 SUBMITTALS

A. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

B. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

C. Certificates: Certify that grease or oil interceptors meet or exceed specified requirements.

D. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

E. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors.

F. Operation Data: Indicate frequency of treatment required for interceptors.

G. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

1.07 EXTRA MATERIALS

A. Supply for North Providence School Department's use in maintenance of project:
   1. Two loose keys for outside hose bibbs.
   2. Two hose end vacuum breakers for hose bibbs.

PART 2 PRODUCTS

2.01 DRAINS

A. Manufacturers:
   1. Josam Company: www.josam.com/#sle.
   2. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
   3. Zurn Industries, Inc: www.zurn.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Roof Drains:
   1. Assembly: ASME A112.6.4.
   2. Body: Lacquered cast iron with sump.
   3. Strainer: Removable polyethylene, cast metal, cast bronze, or cast iron dome with vandal proof screws.
   4. Accessories: Coordinate with roofing type.
      a. Membrane flange and membrane clamp with integral gravel stop.
      b. Adjustable under deck clamp.
      c. Roof sump receiver.
      d. Waterproofing flange.
      e. Controlled flow weir.
      f. Leveling frame.
      g. Adjustable extension sleeve for roof insulation.
      h. Perforated or slotted ballast guard extension for inverted roof.
      i. Perforated stainless steel ballast guard extension.

C. Parapet Drains:
   1. Lacquered or Galvanized cast iron body with aluminum flashing clamp collar and epoxy coated or nickel bronze sloping grate.

D. Canopy and Cornice Drains:
   1. Lacquered or Galvanized cast iron body with aluminum flashing clamp collar and epoxy coated or nickel bronze flat strainer.

E. Roof Overflow Drains:
   1. Lacquered or Galvanized cast iron body and clamp collar and bottom clamp ring; pipe extended to above flood elevation.

F. Downspout Nozzles:
   1. Bronze round with straight bottom section.

G. Area Drains:
   1. Assembly: ASME A112.6.4.
   2. Body: Lacquered cast iron with sump.
   3. Strainer: Round nickel-bronze.
   4. Accessories: Membrane flange and membrane clamp with integral gravel stop, with adjustable under deck clamp, roof sump receiver, waterproofing flange, levelling frame,

adjustable extension sleeve (for insulation), and perforated stainless steel ballast guard extension.

H. Floor Drain:
   1. Round, type 304 stainless steel adjustable floor drain with anchor flange and medium-duty vertically adjustable satin finish top.

2.02 CLEANOUTS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
   2. Josam Company: www.josam.com/#sle.
   3. Zurn Industries, Inc: www.zurn.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Cleanouts at Exterior Surfaced Areas:
   1. Round cast nickel bronze access frame and non-skid cover.

C. Cleanouts at Exterior Unsurfaced Areas:
   1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.

D. Cleanouts at Interior Finished Floor Areas:
   1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

E. Cleanouts at Interior Finished Wall Areas:
   1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

F. Cleanouts at Interior Unfinished Accessible Areas: Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.03 HYDRANTS

A. Manufacturers:
   1. Arrowhead Brass Company: www.arrowheadbrass.com/#sle.
   2. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
   3. Zurn Industries, Inc: www.zurn.com/#sle.

B. Wall Hydrants: Exterior
   1. ASSE 1019; tamper-proof, freeze resistant, self-draining type with chrome plated wall plate hose thread spout, handwheel, and integral vacuum breaker.

C. Roof Hydrant:
   1. Freezeless, cast iron support components. Drain connection, EPDM Boot.

2.04 BACKFLOW PREVENTERS

A. Manufacturers:
   1. Conbraco Industries: www.conbraco.com/#sle.
   2. Watts Regulator Company: www.wattsregulator.com/#sle.
   3. Zurn Industries, Inc: www.zurn.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Reduced Pressure Backflow Preventers:
   1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

2.05 DOUBLE CHECK VALVE ASSEMBLIES

A. Manufacturers:
   1. Conbraco Industries: www.conbraco.com/#sle.

2. Watts Regulator Company: www.wattsregulator.com/#sle.
3. Zurn Industries, Inc: www.zurn.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Double Check Valve Assemblies:
1. ASSE 1012; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

2.06 WATER HAMMER ARRESTORS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
2. Watts Regulator Company: www.wattsregulator.com/#sle.
3. Zurn Industries, Inc: www.zurn.com/#sle.
4. Souix Chief Company.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Water Hammer Arrestors:
1. Stainless steel construction, bellows or piston type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range -100 to 300 degrees F and maximum 250 psi working pressure.

2.07 MIXING VALVES

A. Thermostatic Mixing Valves:
1. Manufacturers:
a. ESBE: www.esbe.se/en.
b. Leonard Valve Company: www.leonardvalve.com.
c. Honeywell Water Controls: http://yourhome.honeywell.com/#sle.
d. Substitutions: See Section 01 60 00 - Product Requirements.
2. Valve: Chrome plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment.
3. Accessories:
a. Check valve on inlets.
b. Volume control shut-off valve on outlet.
c. Stem thermometer on outlet.
d. Strainer stop checks on inlets.
4. Cabinet: 16 gage prime coated steel, for recessed mounting with keyed lock.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install floor cleanouts at elevation to accommodate finished floor.

E. Install approved portable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.

F. Pipe relief from backflow preventer to nearest drain.

G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatories, sinks, washing machines, toilets, urinal and any other quick closing valves .

END OF SECTION 22 10 06

SECTION 22 30 00
PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water heaters.

B. Expansion Tanks.

C. Pumps.
   1. Circulators.
   2. Sump / Sewage Pumps.

D. Water pressure booster system.

1.02 RELATED REQUIREMENTS

A. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ANSI Z21.10.1 - Gas Water Heaters - Volume I - Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less.

B. ANSI Z21.10.3 - Gas-Fired Water Heaters - Volume III - Storage Water Heaters with Input Ratings Above 75,000 Btu per Hour, Circulating and Instantaneous.

C. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; The American Society of Mechanical Engineers.

1.04 SUBMITTALS

A. Product Data:
   1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
   2. Indicate pump type, capacity, power requirements.
   3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
   4. Provide electrical characteristics and connection requirements.

B. Shop Drawings:
   1. Indicate heat exchanger dimensions, size of tappings, and performance data.
   2. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

C. Manufacturer's Instructions .

D. Project Record Documents: Record actual locations of components .

E. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in North Providence School Department's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of experience.

B. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

C. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.06 CERTIFICATIONS

A. Water Heaters: NSF approved.

B. Gas Water Heaters: Certified by CSA International to 1 or 2, as applicable, in addition to requirements specified elsewhere.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.08 WARRANTY

A. Provide five year manufacturer warranty for domestic water heaters and in-line circulator.

1.09 EXTRA MATERIALS

A. Provide two pump seals.

PART 2 PRODUCTS

2.01 COMMERCIAL GAS FIRED WATER HEATERS

A. Type: Automatic, tankless propane-fired.

B. Manufacturers:
1. Noritz
2. Rinnai
3. Substitutions: See Section 01 60 00 - Product Requirements.

C. Performance: See plans.

D. Accessories: Provide:
1. Venting Kit.
2. Isolation Valves

E. Certification: As water heater by ASME, rated for output temperatures of 100 to 180 degrees F.
.

F. Controls: Digital controls for output temperature management (default setting at 120 degrees), safety controls for flame failure, boiling protection, combustion fan failure, over-current, and gas valve failure. .

2.02 DIAPHRAGM-TYPE COMPRESSION TANKS

A. Manufacturers:
1. Amtrol Inc: www.amtrol.com/#sle.
2. ITT Bell & Gossett: www.bellgossett.com/#sle.
3. Taco, Inc: www.taco-hvac.com/#sle.

B. Construction: Welded steel, tested and stamped in accordance with ASME (BPV VIII, 1); supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible diaphragm sealed into tank, and steel legs or saddles.

C. Accessories: Pressure gage and air-charging fitting, tank drain; precharge to 55 psig.

2.03 IN-LINE CIRCULATOR PUMPS

A. Manufacturers:
1. Armstrong Pumps Inc: www.armstrongpumps.com/#sle.
2. ITT Bell & Gossett: www.bellgossett.com/#sle.
3. SIHI Group: www.sterlingsihi.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Casing: Bronze, rated for 125 psig working pressure.

C. Impeller: Bronze.

D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.

E. Seal: Carbon rotating against a stationary ceramic seat.

F. Drive: Flexible coupling.

2.04 PRESSURE BOOSTER SYSTEMS

A. Manufacturers: See Schedule

B. System: Packaged with two pumps, factory assembled, tested, and adjusted; shipped to site as integral unit; consisting of pumps, valves, and piping, with control panel assembled on fabricated steel base with structural steel framework.

C. Structural Elements: The entire system shall be factory skid mounted on a minimum; 304 stainless-steel structural square tube support frame, with in-shear molded rubber vibration isolators. Horizontal systems shall feature a rack-style servicing system which will allow the user access to the pump and motor while the pump can remains on the system skid. (see plans for details)

D. Valves: All valves shall be full port bronze ball valves, with S.S. ball and stem design for valve sizes 2 1/2" and smaller, and cast iron, epoxy coated lever operated, grooved end type butterfly valves, with stainless steel disc, and Stainless Steel shaft, for valve sizes 3" and larger. Valves must be rated for maximum pressure service for the system and also comply with NSF 61 Drinking Water requirements.

E. Control Panel: The pumping system control panel shall incorporate the following elements, and criteria:
   1. The pump controller, and all its components shall be housed in a NEMA 3R, UL listed, ventilated control enclosure. The controller shall have a main power disconnect switch, with enclosure door interlock, which shall require opening the disconnect switch before the control cabinet may be opened. The system shall provide for a single point electrical connection, with all power, both primary, and secondary to be de-activated with opening the main disconnect switch.
   2. The entire controller shall be UL 508A listed, INDUSTRIAL CONTROL PANELS, and have all UL listed devices of Touch Safe design, which shall eliminate any bare handed shock hazard. All primary and secondary power circuits shall be protected through the use of Touch Safe panel design.
   3. All secondary control circuit wiring shall be 24 volts, AC/DC, or less, to include all pilot lights, selector switches, panel meters, HMI, PLC and alarm devices. The Primary motor branch circuits shall have thermal magnetic circuit breaker protection, (fuses shall not be acceptable). There shall be no part of the interior of the control enclosure, which shall produce a bare handed shock hazard even with the controller powered up. There shall be no exceptions to this requirement.
   4. The controller shall utilize a programmable 24 volt EEPROM control module, which shall provide all pump staging, and timing functions. Low Suction and High System alarm conditions shall have audible and visual indicators, with timed delayed proof of condition and automatic reset. The EEPROM Module shall provide for automatic alternation between equal pumps. Pressure-based pump sequencing is unacceptable since a change in suction pressure can skew the lag sequencing point. Pump sequencing must be accomplished through electronic means allowing for the lag pump to carry the load prior to the lead handing off. Control system will guarantee PSI deviation of no more than +/- 1PSI on pump time-out alternation. Pump alternation shall enunciate on the main screen. There shall be no failure of any one system component which will render the system incapable of maintaining system flow to the building. All controls must be 100% fail-safe including failure of the PLC.
   5. The controller panel shall have the following features:
      a. NEMA 4, 256 color, 6” Touch Screen interface shall provide access to all timing, control and informational feedback on all system operations. This HMI shall provide for re-calibration of the system and all system parameters without the need to open the control panel door.
      b. Touch screen shall include panel screen access to a logged alarm function with time and date stamp.

c. Touch screen shall incorporate a key logger able to save the last 400 button pushes in a non-volatile PLC memory.
d. Touch screen shall incorporate a PSI trending chart with the ability to export information including VFD speed, system PSI, KW, run times in an exportable CSV format on an externally removable USB flash drive.
e. All pump functions shall be accessible including Run Hours, Amperage, PSI and system temperature and remaining time until shutdown.
f. System shall provide for an optional BACNet communications including the ability to monitor and control the system remotely.
g. Provide three phase lightning protection for entire control panel.
h. Main power un-fused, door interlocked disconnect switch.
i. Individual, glycerin filled, panel mounted, stainless steel suction and system pressure gauges.
j. Low Suction Condition, and High System Pressure alarms, both audible, and visual
k. Automatic pump alternation between equal split pumps.
l. Low suction condition shall be initiated via a separate dedicated pressure switch(for pressure feed systems), or a liquid level float switch, (for break tank operation).
m. All control components shall be UL Listed, or recognized devices.
n. The controller shall be UL 508 Listed, and in accordance with the National Electrical Code, (NEC).

6. All components shall be of standard manufacture, and not be of proprietary sole source. Manufacturer will have these spare parts available either through local product representation or directly from the manufacturer via Next Day shipping.

F. Pump Sequencing: All pump sequencing shall be initiated and controlled via the PLC. Upon pressure drop, the Lead pump shall initiate and run to attempt to satisfy demand. An empty pipe condition is to be determined by an algorithm allowing for a slow ramp to set point to prevent system pressure shocks. In the event the pressure set point is not satisfied or the pump is being overloaded, an additional pump shall immediately initiate to assist the lead pump in meeting demand. After the pressure set point is reached, the pumps shall continue to meet demand, if demand decreases, a sensor less means of control shall immediately shut down the pump to prevent no flow conditions and to prevent short cycling of the pumps. These algorithms take into account system pressure and system demand, the system shall revert to the stand-by mode (no flow shutdown) when no flow is present. A continuously monitored motor FLA algorithm shall prevent any motor from overloading and initialize additional pumps to share system demand. The system shall employ algorithms to detect pipe break and stop system, initiate an alarm and log the event. In the event of a sensor loss, the system shall run one pump in a semi-automatic mode allowing the building to maintain a minimum pressure until the sensor can be repaired or replaced. An automated PID algorithm shall continuously monitor system pressure and auto-tune the PID based on demand allowing for fast system demand response while maintaining smooth steady state pressure. The PID algorithms shall incorporate intelligent algorithms to start the pumps at the point of creating pressure saving energy and reducing time to set pressure upon pump call. The software will also contain GreenFlo™, an algorithm to allow the system to fully comply with the newly adopted requirements of ANSI/ASHRAE/IES, Standard 90.1 - 2010; also referred to as the “Energy Standard for Buildings”.

G. The system shall not require external flow meters or KW monitoring. The system will not implement speed, thermal or time delay means to detect and shut down pumps on a no demand condition as this wastes energy and provides for unnecessary run times.

H. Bladder Tank: No bladder tank is recommended, or required for this type system as there is no pressure change at the discharge of the pump. Since there is no pressure change, a tank is un-usable in a variable speed booster application.

I. Pressure Regulation: Pressure regulation is provided via the variable frequency drive controllers, with PID control. No other pressure regulators are required. In the event of any drive failure, next drive in sequence shall start automatically and the failed drive shall indicate a fault condition. In the event of a loss of transducer signal, the system shall be pre-programmed

to a fail-safe mode which will ramp pumps to a safe-speed and maintain positive pressure on the system piping without shutting the system down. All system and drive settings shall be re-settable from the HMI (touch screen) including PID values without the need to open the controller door.

J. Fabrication:
   1. All headers, nipples, and welded attachments to the headers shall be type 304 stainless steel materials.
   2. All welding shall be in accordance with section IX of the ASME Boiler and Pressure Vessel code, and shall be performed by welders qualified under that standard
   3. The completed system shall be hydrostatically and performance tested to simulated jobsite conditions and pre-set for plug and play operation. Copies of these test reports shall be provided in the O&M Manuals which will be turned over to the owner. These manuals shall included all settings, explanation of these operations and final test reports from the factory test.
   4. Each pump shall have an individual resilient seated non-slam type check valve on each pump immediately downstream of the pump discharge.
   5. All pumps shall be mounted utilizing in-shear rubber vibration isolators mounted to the motor bases
   6. All stainless steel surfaces shall feature a consistent brushed metal finish so that all exposed stainless surfaces are identical in material finish.

K. Start-up:
   1. Initial factory start-up, and owner training shall be performed by a qualified factory trained technician. A factory certified start-up report must be provide to the owner, dated and signed by the factory technician.

L. Parts: A complete listing of all components in the manufacture of the equipment shall be provide in the O&M including individual factory part numbers for each component in the packaged equipment.

M. Owner Training: The owner instruction, and training shall include, but not be limited to the following:
   1. Training in the replacement of the motor, mechanical seals and pump impeller.
   2. Safe replacement of electrical components.
   3. Proper operation of the system, troubleshooting, alarm, and reset features

N. On-Site Factory Warranty: Provide a 2-year Factory sponsored extended warranties for all equipment servicing common areas. Warranty shall include both parts and labor in the event of a failure of any equipment in accordance with factory warranty certificate. Warranty repairs must be performed by the manufacturer or a properly trained factory authorized service representative.

2.05 SUMP PUMPS

A. Manufacturers:
   1. ITT Bell & Gossett.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Type: Vertical centrifugal, direct connected, duplex arrangement.

C. Casing: Cast iron volute with radial clearance around impeller .

D. Impeller: Cast iron; enclosed or semi-open non-clog, keyed to stainless steel shaft.

E. Support: Cast iron pedestal motor support on steel floor plate with gas tight gaskets.

F. Bearings: Forced grease lubricated bronze sleeve spaced maximum 48 inches and grease lubricated ball thrust at floor plate.

G. Drive: Flexible coupling to vertical, solid shaft ball bearing electric motor.

H. Sump: Fiberglass with lockable painted aluminum inspection cover and alarm fittings.

I. Controls (Duplex): Float operated mechanical alternator with float rod, stops, and corrosion resistant float to alternate operation of pumps, cut-in second pump on rising level or lead pump

failure, separate pressure switch high level alarm with transformer, alarm bell, and standpipe, and emergency float switch with float rod, stops, and corrosion resistant float to operate both pumps on failure of alternator.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Coordinate with plumbing piping and related gas venting and electrical work to achieve operating system.

C. Pumps:
   1. Provide air cock and drain connection on horizontal pump casings.
   2. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.
   3. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and over.
   4. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
   5. Align and verify alignment of base mounted pumps prior to start-up.

END OF SECTION 22 30 00

SECTION 22 40 00
PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water closets.

B. Urinals.

C. Lavatories.

D. Sinks.

E. Service sinks.

F. Drinking fountains.

1.02 RELATED REQUIREMENTS

A. Section 07 90 05 - Joint Sealers: Seal fixtures to walls and floors.

B. Section 22 10 05 - Plumbing Piping.

C. Section 22 10 06 - Plumbing Piping Specialties.

D. Section 22 30 00 - Plumbing Equipment.

E. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ANSI Z124.1 - American National Standard for Plastic Bathtub Units; 1995.

B. ANSI Z124.2 - American National Standard for Plastic Shower Units; 1995.

C. ANSI Z124.1.2 - American National Standard for Plastic Bathtub and Shower Units.

D. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment.

E. ARI 1010 - Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers; Air-Conditioning and Refrigeration Institute.

F. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use.

G. ASME A112.18.1 - Plumbing Supply Fittings.

H. ASME A112.19.1M - Enameled Cast Iron Plumbing Fixtures; The American Society of Mechanical Engineers.

I. ASME A112.19.2 - Ceramic Plumbing Fixtures.

J. ASME A112.19.3 - Stainless Steel Plumbing Fixtures.

K. ASME A112.19.4M - Porcelain Enameled Formed Steel Plumbing Fixtures.

L. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks.

M. ASME A112.19.14 - Six Liter Water Closets Equipped with Dual Flushing Device.

1.04 SUBMITTALS

A. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

B. Samples: Submit two sets of color chips for each standard color.

C. Manufacturer's Instructions: Indicate installation methods and procedures.

D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

E. Waterless Urinals: Submit recommended frequency of maintenance and parts replacement, methods of cleaning, sources of replacement supplies and parts.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in North Providence School Department's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of experience.

1.06 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.07 MOCK-UP

A. Provide mock-up of typical bathroom group.

B. Mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.09 WARRANTY

A. Provide five year manufacturer warranty for electric water cooler.

1.10 EXTRA MATERIALS

A. Supply two sets of faucet washers, flush valve service kits, and lavatory supply fittings.

PART 2 PRODUCTS

2.01 FLUSH VALVE WATER CLOSETS

A. Water Closets: Vitreous china, ASME A112.19.2, floor mounted, siphon jet flush action, china bolt caps.
   1. Flush Volume: 1.28 gallon, maximum.
   2. Flush Valve: Exposed (top spud).
   3. Flush Operation: Sensor operated, push-button override.
   4. Handle Height: 44 inches or less.
   5. Manufacturers:
      a. American Standard Inc: www.americanstandard.com.
      b. Kohler.
      c. Toto USA: www.totousa.com.
      d. Zurn Industries, Inc: www.zurn.com/#sle.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

B. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
   1. Sensor-Operated Type: Solenoid operator, battery powered with self-generating hydro-electric turbine, infrared sensor and over-ride push button.
   2. ASME A112.19.2; floor mounted, siphon jet or wall hung blow out vitreous china closet bowl, with elongated rim, 1-1/2 inch top spud, china bolt caps.
   3. Manufacturers:
      a. Toto USA: www.totousa.com
      b. Sloan Valve Company: www.sloanvalve.com.
      c. Zurn Industries, Inc: www.zurn.com.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

C. Seats:
   1. Manufacturers:
      a. Kohler
      b. Bemis Manufacturing Company: www.bemismfg.com/#sle.
      c. Church Seat Company: www.churchseats.com/#sle.

d. Olsonite: www.olsonite.com/#sle.
e. Substitutions: See Section 01 60 00 - Product Requirements.

2. Solid plastic, open front, extended back, brass bolts, with cover.

D. Water Closet Carriers:
1. Manufacturers:
a. JR Smith.
b. Sloan Valve Company: www.sloanvalve.com.
c. Zurn Industries, Inc: www.zurn.com/#sle.
d. Substitutions: See Section 01 60 00 - Product Requirements.
2. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2.02 WALL HUNG URINALS

A. Wall Hung Urinal Manufacturers:
1. Kohler Company: www.kohler.com/#sle.
2. Zurn Industries, Inc: www.zurn.com/#sle.

B. Urinals: Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.
1. Flush Volume: 1/8 gallon (0.5 liter).
2. Flush Style: Washout.
3. Trap: Integral.

C. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
1. Sensor-Operated Type: Solenoid operator, battery powered with self-generating hydro-electric turbine, infrared sensor and over-ride push button.

D. Carriers:
1. Manufacturers:
a. JR Smith
b. Sloan Valve Company: www.sloanvalve.com.
c. Zurn Industries, Inc: www.zurn.com/#sle.
2. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

2.03 LAVATORIES

A. Lavatory Manufacturers:
1. American Standard Inc
2. Eljer
3. Kohler Company: www.kohler.com/#sle.
4. Zurn Industries, Inc: www.zurn.com/#sle.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Sensor Operated Faucet: Cast brass, chrome plated, deck mounted with sensor located on neck of spout.
1. Spout Style: Standard,
2. Power Supply: Self-generating, hydro-powered turbine charging rechargeable battery.
3. Mixing Valve: automatic.
4. Water Supply: 1/2 inch compression connections.
5. Aerator: Vandal resistant, 1 GPM, .
6. Automatic Shut-off: 30 seconds.
7. Sensor range: Automatically adjusts.
a. Accessory: Optional remote reprogrammer module to adjust pre-set factory functions.
8. Finish: Polished chrome.
9. Accessory: 4 inch or 8 inch deck plate.
10. Sensor Operated Faucet Manufacturers:
a. American Standard Inc: www.americanstandard.com.

b. Sloan Valve Company: www.sloanvalve.com/#sle.
c. Toto USA: www.totousa.com/#sle.
d. Zurn industries, Inc: www.zurn.com.

C. Accessories:
1. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.
2. Offset waste with perforated open strainer.
3. Screwdriver stops.
4. Rigid supplies.
5. Carrier:
a. Manufacturers:
1) JR Smith
2) Sloan Valve Company: www.sloanvalve.com.
3) Zurn Industries, Inc: www.zurn.com/#sle.
b. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, or concealed arm supports bearing plate and studs.

2.04 WATER FOUNTAINS

A. Electric Water Cooler Manufacturers:
1. Tri Palm International/Oasis: www.tripalmint.com.
2. Elkay Manufacturing Company: www.elkay.com/#sle.
3. Haws Corporation: www.hawsco.com/#sle.

B. Fountain:
1. A surface handicapped-height, fully ADA compliant mounted water fountain with stainless steel top, stainless steel; stainless steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, bottle filling station, and mounting bracket.
.

2.05 SERVICE SINKS

A. Service Sink Manufacturers:
1. Kohler
2. Elkay Manufacturing Company: www.elkay.com/#sle.

B. Bowl:
1. White floor mounted, with one inch wide shoulders. Vinyl bumper guard stainless steel strainer.

C. Trim:
1. ASME A112.18.1 exposed wall type supply with cross handles, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges.

D. Accessories:
1. 5 feet of 1/2 inch diameter plain end reinforced plastic or rubber hose.
2. Hose clamp hanger.
3. Mop hanger.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid or flexible supplies to fixtures with screwdriver stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall supports or wall carriers and bolts.

E. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07 90 05, color to match fixture.

F. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

A. Clean plumbing fixtures and equipment.

END OF SECTION 22 40 00

SECTION 23 05 13

MOTOR REQUIREMENTS FOR HVAC AND PLUMBING EQUIP

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single phase electric motors.

B. Three phase electric motors.

1.02 RELATED REQUIREMENTS

A. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

B. Section 26 29 13 - Enclosed Controllers.

1.03 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators.

C. NEMA MG 1 - Motors and Generators.

D. NFPA 70 - National Electrical Code.

E. National Grid "Motor-Up" Rebate Program/Initiative.

1.04 SUBMITTALS

A. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

B. Test Reports: Indicate test results verifying nominal efficiency and power factor for three phase motors larger than 1/2 horsepower.

C. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

D. Operation Data: Include instructions for safe operating procedures.

E. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of electric motors for HVAC use, and their accessories, with minimum three years documented product development, testing, and manufacturing experience.

B. Conform to applicable electrical code, NFPA 70 and local energy code.

C. Provide certificate of compliance from authority having jurisdiction indicating approval of high efficiency motors.

D. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.07 WARRANTY

A. Provide five year manufacturer warranty for motors larger than 20 horsepower.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Lincoln Motors: www.lincolnmotors.com/#sle.

B. A. O. Smith Electrical Products Company: www.aosmithmotors.com/#sle.

C. Reliance Electric/Rockwell Automation: www.reliance.com.

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service: Refer to Section 26 27 17 for required electrical characteristics.

B. Electrical Service, General. See drawings for specific details:
   1. Motors 1/2 HP and Smaller: 115 volts, single phase, 60 Hz
   2. Motors Larger than 1/2 Horsepower: 460 volts, three phase, 60 Hz.

C. Construction:
   1. Open drip-proof type except where specifically noted otherwise.
   2. Design for continuous operation in 40 degrees C environment.
   3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
   4. Motors with frame sizes 254T and larger: Premium Efficiency Type.

D. Explosion-Proof Motors: UL approved and labelled for hazard classification, with over temperature protection.

E. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor.

F. Wiring Terminations:
   1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
   2. For fractional horsepower motors where connection is made directly, provide conduit connection in end frame.

2.03 APPLICATIONS

A. Exception: Motors less than 250 watts, for intermittent service may be the equipment manufacturer's standard and need not conform to these specifications.

B. Single phase motors for shaft mounted fans and centrifugal pumps: Split phase type.

C. Single phase motors for shaft mounted fans or blowers: Permanent split capacitor type or electronically commutated (ECM) type. See schedules for requirements.

D. Single phase motors for fans, pumps, and blowers: Capacitor start type.

E. Single phase motors for fans, blowers, and pumps: Capacitor start, capacitor run type.

F. Motors located in outdoors and in draw through cooling towers: Totally enclosed weatherproof epoxy-treated type.

2.04 SINGLE PHASE POWER - SPLIT PHASE MOTORS

A. Starting Torque: Less than 150 percent of full load torque.

B. Starting Current: Up to seven times full load current.

C. Breakdown Torque: Approximately 200 percent of full load torque.

D. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.

E. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.05 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

A. Starting Torque: Exceeding one fourth of full load torque.

B. Starting Current: Up to six times full load current.

C. Multiple Speed: Through tapped windings.

D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.06 SINGLE PHASE POWER - CAPACITOR START MOTORS

A. Starting Torque: Three times full load torque.

B. Starting Current: Less than five times full load current.

C. Pull-up Torque: Up to 350 percent of full load torque.

D. Breakdown Torque: Approximately 250 percent of full load torque.

E. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.

F. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.

G. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.07 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors.

E. Insulation System: NEMA Class B or better.

F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

H. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter; refer to Section 26 29 13.

I. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

J. Sound Power Levels: To NEMA MG 1.

K. Part Winding Start Above 254T Frame Size: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.

L. Weatherproof Epoxy Sealed Motors: Epoxy seal windings using vacuum and pressure with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.

M. Nominal Efficiency: As scheduled at full load and rated voltage when tested in accordance with IEEE 112.

N. Nominal Power Factor: As scheduled at full load and rated voltage when tested in accordance with IEEE 112.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

D. Provide detailed installation and purchase information for reimbursement by Utility for rebate program.

3.02 SCHEDULE - PREMIUM EFFICIENCY

A. NEMA Open Motor Service Factors.
   1. 1/6-1/3 hp:
      a. 3600 rpm: 1.35.
      b. 1800 rpm: 1.35.
      c. 1200 rpm: 1.35.
      d. 900 rpm: 1.35.
   2. 1/2 hp:
      a. 3600 rpm: 1.25.
      b. 1800 rpm: 1.25.
      c. 1200 rpm: 1.25.
      d. 900 rpm: 1.15.
   3. 3/4 hp:
      a. 3600 rpm: 1.25.
      b. 1800 rpm: 1.25.
      c. 1200 rpm: 1.15.
      d. 900 rpm: 1.15.
   4. 1 hp:
      a. 3600 rpm: 1.25.
      b. 1800 rpm: 1.15.
      c. 1200 rpm: 1.15.
      d. 900 rpm: 1.15.
   5. 1.5-150 hp:
      a. 3600 rpm: 1.15.
      b. 1800 rpm: 1.15.
      c. 1200 rpm: 1.15.
      d. 900 rpm: 1.15.

B. Three Phase - Premium Efficiency, Open Drip-Proof Performance:
   1. Ratings.
      a. 1 hp:
         1) NEMA Frame: 145T.
         2) Minimum Percent Power Factor: 72.
         3) Minimum Percent Efficiency: 82.5% @ 1200 RPM, 85.5%@ 1800 RPM, 77% @ 3600 RPM
      b. 1-1/2 hp:
         1) NEMA Frame: 182T.
         2) Minimum Percent Power Factor: 73.
         3) Minimum Percent Efficiency: 86.5% @ 1200 RPM, 86.5% @ 1800 RPM, 84% @ 3600 RPM
      c. 2 hp:
         1) NEMA Frame: 184T.
         2) Minimum Percent Power Factor: 75.
         3) Minimum Percent Efficiency: 87.5% @ 1200 RPM, 86.5% @ 1800 RPM, 85.5% @ 3600 RPM
      d. 3 hp:
         1) NEMA Frame: 213T.
         2) Minimum Percent Power Factor: 60.

3) Minimum Percent Efficiency: 88.5% @ 1200 RPM, 89.5% @ 1800 RPM, 85.5% @ 3600 RPM

e. 5 hp:
   1) NEMA Frame: 215T.
   2) Minimum Percent Power Factor: 65.
   3) Minimum Percent Efficiency: 89.5% @ 1200 RPM, 89.5% @ 1800 RPM, 86.5% @ 3600 RPM

f. 7-1/2 hp:
   1) NEMA Frame: 254T.
   2) Minimum Percent Power Factor: 73.
   3) Minimum Percent Efficiency: 90.2% @ 1200 RPM, 91% @ 1800 RPM, 88.5% @ 3600 RPM

g. 10 hp:
   1) NEMA Frame: 256T.
   2) Minimum Percent Power Factor: 74.
   3) Minimum Percent Efficiency: 91.7% @ 1200 RPM, 91.7% @ 1800 RPM, 89.5% @ 3600 RPM

h. 15 hp:
   1) NEMA Frame: 284T.
   2) Minimum Percent Power Factor: 77.
   3) Minimum Percent Efficiency: 91.7% @ 1200 RPM, 93% @ 1800 RPM, 90.2% @ 3600 RPM.

i. 20 hp:
   1) NEMA Frame: 286T.
   2) Minimum Percent Power Factor: 78.
   3) Minimum Percent Efficiency: 92.4% @ 1200 RPM, 93% @ 1800 RPM, 91% @ 3600 RPM

j. 25 hp:
   1) NEMA Frame: 324T.
   2) Minimum Percent Power Factor: 74.
   3) Minimum Percent Efficiency: 93% @ 1200 RPM, 93.6% @ 1800 RPM, 91.7% @ 3600 RPM

k. 30 hp:
   1) NEMA Frame: 326T.
   2) Minimum Percent Power Factor: 78.
   3) Minimum Percent Efficiency: 93.6% @ 1200 RPM, 94.1% @ 1800 RPM, 91.7% @ 3600 RPM

l. 40 hp:
   1) NEMA Frame: 364T.
   2) Minimum Percent Power Factor: 77.
   3) Minimum Percent Efficiency: 94.1% @ 1200 RPM, 94.1 @ 1800 RPM, 92.4% @ 3600 RPM

m. 50 hp:
   1) NEMA Frame: 365T.
   2) Minimum Percent Power Factor: 79.
   3) Minimum Percent Efficiency: 94.1% @ 1200 RPM, 94.5% @ 1800 RPM, 93% @ 3600 RPM

n. 60 hp:
   1) NEMA Frame: 404T.
   2) Minimum Percent Power Factor: 82.
   3) Minimum Percent Efficiency: 93.

o. 75 hp:
   1) NEMA Frame: 405T.
   2) Minimum Percent Power Factor: 80.

3) Minimum Percent Efficiency: 93.

p. 100 hp:
1) NEMA Frame: 444T.
2) Minimum Percent Power Factor: 80.
3) Minimum Percent Efficiency: 93.

C. Three Phase - Premuim Efficiency, Totally Enclosed, Fan Cooled Performance:
1. 1200 rpm.
a. 1 hp:
1) NEMA Frame: 145T.
2) Minimum Percent Power Factor: 72.
3) Minimum Percent Efficiency: 82.5% @ 1200 RPM, 85.5% 2 1800 RPM, 77% @ 3600 RPM

b. 1-1/2 hp:
1) NEMA Frame: 182T.
2) Minimum Percent Power Factor: 73.
3) Minimum Percent Efficiency: 87.5% @ 1200 RPM, 86.5% @ 1800 RPM, 84% @ 3600 RPM

c. 2 hp:
1) NEMA Frame: 184T.
2) Minimum Percent Power Factor: 68.
3) Minimum Percent Efficiency: 88.5% @ 1200 RPM, 86.5% @ 1800 RPM, 85.5% @ 3600 RPM

d. 3 hp:
1) NEMA Frame: 213T.
2) Minimum Percent Power Factor: 63.
3) Minimum Percent Efficiency: 89.5% @ 1200 RPM, 89.5% @ 1800 RPM, 86.5% @ 3600 RPM

e. 5 hp:
1) NEMA Frame: 215T.
2) Minimum Percent Power Factor: 66.
3) Minimum Percent Efficiency: 89.5% @ 1200 RPM, 89.5% @ 1800 RPM, 88.5% @ 3600 RPM

f. 7-1/2 hp:
1) NEMA Frame: 254T.
2) Minimum Percent Power Factor: 68.
3) Minimum Percent Efficiency: 91% @ 1200 RPM, 91.7% @ 1800 RPM, 89.5% @ 3600 RPM

g. 10 hp:
1) NEMA Frame: 256T.
2) Minimum Percent Power Factor: 75.
3) Minimum Percent Efficiency: 91% @ 1200 RPM, 91.7% @ 1800 RPM, 90.2% @ 3600 RPM

h. 15 hp:
1) NEMA Frame: 284T.
2) Minimum Percent Power Factor: 72.
3) Minimum Percent Efficiency: 91.7% @ 1200 RPM, 92.4% @ 1800 RPM, 91% @ 3600 RPM

i. 20 hp:
1) NEMA Frame: 286T.
2) Minimum Percent Power Factor: 76.
3) Minimum Percent Efficiency: 91.7% @ 1200 RPM, 93% @ 1800 RPM, 91% @ 3600 RPM

j. 25 hp:
1) NEMA Frame: 324T.

2) Minimum Percent Power Factor: 71.
3) Minimum Percent Efficiency: 93% @ 1200 RPM, 93.6% @ 1800 RPM, 91.7% @ 3600 RPM

k. 30 hp:
1) NEMA Frame: 326T.
2) Minimum Percent Power Factor: 79.
3) Minimum Percent Efficiency: 93% @ 1200 RPM, 93.6% @ 1800 RPM, 91.7% @ 3600 RPM.

l. 40 hp:
1) NEMA Frame: 364T.
2) Minimum Percent Power Factor: 78.
3) Minimum Percent Efficiency: 94.1% @ 1200 RPM, 94.1% @ 1800 RPM, 92.4% @ 3600 RPM

m. 50 hp:
1) NEMA Frame: 365T.
2) Minimum Percent Power Factor: 81.
3) Minimum Percent Efficiency: 94.1% @ 1200 RPM, 94.5% @ 1800 RPM, 93% @ 3600 RPM

n. Over 50 HP - Refer to National Grid "Motor Up" Energy Efficiency requirements for reimbursement.

END OF SECTION 23 05 13

SECTION 23 05 48

VIBRATION AND SEISMIC CON. FOR EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration isolators.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete.

1.03 SUBMITTALS

A. Product Data: Provide schedule of vibration isolator type with location and load on each.

B. Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each. Indicate seismic control measures.

C. Manufacturer's Instructions: Indicate installation instructions with special procedures and setting dimensions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Isolation Technology, Inc: www.isolationtech.com.

B. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.

C. Mason Industries: www.mason-ind.com/#sle.

2.02 PERFORMANCE REQUIREMENTS

A. General:
   1. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.
   2. Steel springs to function without undue stress or overloading.

2.03 VIBRATION ISOLATORS

A. Open Spring Isolators:
   1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
   2. Spring Mounts: Provide with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
   3. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
   4. For Exterior and Humid Areas: Hot dipped galvanized housings and neoprene coated springs.

B. Restrained Open Spring Isolators:
   1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
   2. Spring Mounts: Provide with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
   3. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
   4. Restraint: Provide heavy mounting frame and limit stops.
   5. For Exterior and Humid Areas: Hot dipped galvanized housings and neoprene coated springs.

C. Closed Spring Isolators:
   1. Type : Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.

2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
3. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance.
4. For Exterior and Humid Areas: Hot dipped galvanized housings and neoprene coated springs.

D. Restrained Closed Spring Isolators:
1. Type : Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
3. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance and limit stops.
4. For Exterior and Humid Areas: Hot dipped galvanized housings and neoprene coated springs.

E. Spring Hangers:
1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
2. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators.
3. Misalignment: Capable of 20 degree hanger rod misalignment.
4. For Exterior and Humid Areas: Hot dipped galvanized housings and neoprene coated springs.

F. Neoprene Pad Isolators:
1. Rubber or neoprene waffle pads.
a. Hardness: 30 durometer.
b. Thickness: Minimum 1/2 inch.
c. Maximum Loading: 50 psi.
d. Rib Height: Maximum 0.7 times width.
2. Configuration: Single layer.
3. Configuration: 1/2 inch thick waffle pads bonded each side of 1/4 inch thick steel plate.

G. Rubber Mount or Hanger: Molded rubber designed for 0.4 inch deflection with threaded insert.

H. Glass Fiber Pads: Neoprene jacketed pre-compressed molded glass fiber.

I. Seismic Snubbers:
1. Type: Non-directional and double acting unit consisting of interlocking steel members restrained by neoprene elements.
2. Elements: Replaceable neoprene, minimum of 0.75 inch thick with minimum 1/8 inch air gap.
3. Capacity: 4 times load assigned to mount groupings at 0.4 inch deflection.
4. Attachment Points and Fasteners: Capable of withstanding 3 times rated load capacity of seismic snubber.

J. Roof Mounting Curb: 14 inches high with rigid steel lower section containing adjustable spring pockets with restrained spring isolators, steel upper section to support rooftop equipment, and continuous elastomeric membrane extending from upper section for counterflashing over roofing. Provide acoustical package consisting of interior perimeter angles and cross members to support up to two layers of gypsum board.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Install in accordance with manufacturer's instructions.

B. Bases:
   1. Set steel bases for one inch clearance between housekeeping pad and base.
   2. Set concrete inertia bases for 2 inches clearance between housekeeping pad and base.
   3. Adjust equipment level.

C. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

D. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

E. Provide pairs of horizontal limit springs on fans with more than 6.0 inches WC static pressure, and on hanger supported, horizontally mounted axial fans.

F. Provide seismic snubbers for all equipment, piping, and ductwork mounted on isolators. Each inertia base shall have minimum of four seismic snubbers located close to isolators. Snub equipment designated for post-disaster use to 0.05 inch maximum clearance. Other snubbers shall have clearance between 0.15 inch and 0.25 inch.

G. Support piping connections to equipment mounted on isolators using isolators or resilient hangers as follows:
   1. Up to 4 Inches Pipe Size: First three points of support.
   2. 5 to 8 Inches Pipe Size: First four points of support.
   3. 10 inches Pipe Size and Over: First six points of support.
   4. Select three hangers closest to vibration source for minimum 1.0 inch static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1.0 inch static deflection or 1/2 static deflection of isolated equipment.

3.02 FIELD QUALITY CONTROL

A. Inspect isolated equipment after installation and submit report. Include static deflections.

3.03 SCHEDULE

A. Pipe Isolation Schedule.
   1. 1 Inch Pipe Size: Isolate 120 diameters from equipment.
   2. 2 Inch Pipe Size: Isolate 90 diameters from equipment.
   3. 3 Inch Pipe Size: Isolate 80 diameters from equipment.
   4. 4 Inch Pipe Size: Isolate 75 diameters from equipment.
   5. 6 Inch Pipe Size: Isolate 60 diameters from equipment.
   6. 8 Inch Pipe Size: Isolate 60 diameters from equipment.
   7. 10 Inch Pipe Size: Isolate 54 diameters from equipment.
   8. 12 Inch Pipe Size: Isolate 50 diameters from equipment.
   9. 16 Inch Pipe Size: Isolate 45 diameters from equipment.
   10. 24 Inch Pipe Size: Isolate 38 diameters from equipment.
   11. Over 24 Inch Pipe Size: As indicated.

B. Equipment Isolation Schedule.
   1. Pumps.

END OF SECTION 23 05 48

SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe Markers.

1.02 RELATED REQUIREMENTS

A. Section 09 90 00 - Painting and Coating para. 3.04

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.04 SUBMITTALS

A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Samples: Submit two labels or tags 1/2 x 4 inch in size.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Brady Corporation: www.bradycorp.com.

B. Champion America, Inc: www.Champion-America.com.

C. Seton Identification Products: www.seton.com/aec.

2.02 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/2 inch.
   3. Background Color: Black.

2.03 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

B. Metal Tags: Aluminum with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 STENCILS

A. Stencils: With clean cut symbols and letters of following size:
   1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
   2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
   3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.

4. 8 to 10 inch Outside Diameter of Insulation or Pipe: 24 inch long color field, 2-1/2 inch high letters.
5. Over 10 inch Outside Diameter of Insulation or Pipe: 32 inch long color field, 3-1/2 inch high letters.
6. Ductwork and Equipment: 2-1/2 inch high letters.

B. Stencil Paint: As specified in Section 09 90 00, semi-gloss enamel, colors conforming to ASME A13.1.

2.05 PIPE MARKERS

A. Color: Conform to ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.06 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

B. Color code as follows:
1. HVAC Equipment: Yellow.
2. Fire Dampers and Smoke Dampers: Red.
3. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Apply stencil painting in accordance with Section 09 90 00.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.

H. Identify control panels and major control components outside panels with plastic nameplates.

I. Identify thermostats relating to terminal boxes or valves with nameplates.

J. Identify valves in main and branch piping with tags.

K. Identify air terminal units and radiator valves with numbered tags.

L. Tag automatic controls, instruments, and relays. Key to control schematic.

M. Identify piping, concealed or exposed, with plastic pipe markers, plastic tape pipe markers or stencilled painting. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification

not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

N. Identify ductwork with plastic nameplates or stencilled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

O. Locate ceiling tacks to locate valves, units, or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 23 05 53

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of refrigerating systems.

C. Measurement of final operating condition of HVAC systems.

D. Sound measurement of equipment operating conditions.

E. Vibration measurement of equipment operating conditions.

F. Commissioning activities.

1.02 RELATED REQUIREMENTS

A. Section 01 91 10 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

B. Section 01 91 10 - Functional Testing Procedures

C. Section 23 08 00 - Commissioning of HVAC.

1.03 REFERENCE STANDARDS

A. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council.

B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems.

C. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems.

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing.

1.04 SUBMITTALS

A. Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Submit to Architect.
   2. Submit to the Commissioning Authority, Construction Manager, and HVAC controls contractor.
   3. Submit six weeks prior to starting the testing, adjusting, and balancing work.
   4. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with the Architect and other installers to sufficiently understand the design intent for each system.
   5. Include at least the following in the plan:
      a. Preface: An explanation of the intended use of the control system.
      b. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      c. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      d. Identification and types of measurement instruments to be used and their most recent calibration date.
      e. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      f. Final test report forms to be used.
      g. Detailed step-by-step procedures for TAB work for each system and issue, including:

1) Terminal flow calibration (for each terminal type).
2) Diffuser proportioning.
3) Branch/submain proportioning.
4) Total flow calculations.
5) Rechecking.
6) Diversity issues.

h. Expected problems and solutions, etc.
i. Criteria for using air flow straighteners or relocating flow stations and sensors .
j. Details of how TOTAL flow will be determined; for example:
1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
k. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.
l. Confirmation of understanding of the outside air ventilation criteria under all conditions.
m. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
n. Method of checking building static and exhaust fan and/or relief damper capacity.
o. Proposed selection points for sound measurements and sound measurement methods.
p. Methods for making coil or other system plant capacity measurements, if specified.
q. Time schedule for TAB work to be done in phases (by floor, etc.).
r. Description of TAB work for areas to be built out later, if any.
s. Time schedule for deferred or seasonal TAB work, if specified.
t. False loading of systems to complete TAB work, if specified.
u. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
v. Interstitial cavity differential pressure measurements and calculations, if specified.
w. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
x. Procedures for formal progress reports, including scope and frequency.
y. Procedures for formal deficiency reports, including scope, frequency and distribution.

C. Field Logs: Submit at least once a week to Commissioning Authority and Construction Manager.

D. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

E. Progress Reports.

F. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
1. Submit to the Commissioning Authority, Construction Manager, and HVAC controls contractor within two weeks after completion of testing, adjusting, and balancing.
2. Revise TAB plan to reflect actual procedures and submit as part of final report.
3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
4. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
5. Include actual instrument list, with manufacturer name, serial number, and date of calibration.

6. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
7. Units of Measure: Report data in I-P (inch-pound) units only.
8. Include the following on the title page of each report:
    a. Name of Testing, Adjusting, and Balancing Agency.
    b. Address of Testing, Adjusting, and Balancing Agency.
    c. Telephone number of Testing, Adjusting, and Balancing Agency.
    d. Project name.
    e. Project location.
    f. Project Architect.
    g. Project Engineer.
    h. Project Owners Project Manager.
    i. Project altitude.
    j. Report date.

G. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

1.05 QUALITY ASSURANCE (MOVED TO PART 3)

1.06 PRE-BALANCING MEETING (MOVED TO PART 3)

1.07 SEQUENCING AND SCHEDULING (MOVED TO PART 3)

1.08 WARRANTY (MOVED TO PART 3)

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
1. AABC MN-1, AABC National Standards for Total System Balance.
2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
3. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
4. SMACNA HVAC Systems Testing, Adjusting, and Balancing.
5. Maintain at least one copy of the standard to be used at project site at all times.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
2. Having minimum of three years documented experience.
3. Certified by one of the following:
    a. AABC, Associated Air Balance Council: www.aabchq.com; upon completion submit AABC National Performance Guaranty.
    b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
    c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

F. TAB Supervisor Qualifications: Professional Engineer licensed in Rhode Island.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place and open.
   8. Air coil fins are cleaned and combed.
   9. Access doors are closed and duct end caps are in place.
   10. Air outlets are installed and connected.
   11. Duct system leakage is minimized.
   12. Hydronic systems are flushed, filled, and vented.
   13. Pumps are rotating correctly.
   14. Proper strainer baskets are clean and in place.
   15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
   1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.

C. Provide additional balancing devices as required.

3.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 10 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   3. Contract interpretation requests.
   4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the North Providence School Department.

H. Check and adjust systems approximately six months after final acceptance and submit report.

3.06 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities .

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive and sheave changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

M. Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.

N. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

O. On fan powered VAV boxes, adjust air flow switches for proper operation.

P. For laboratories, lab classrooms, and prep rooms, offset CFM values (differential between exhaust/return and supply airflows) shall be required to maintain a plus 10% minus 5% offset.

3.07 COMMISSIONING

A. Perform prerequisites prior to starting commissioning activities.

B. Fill out Prefunctional Checklists for:
   1. Air side systems.
   2. Refrigeration systems

C. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.

D. Re-check minimum outdoor air intake flows and maximum and intermediate total airflow rates for 10 percent of the air handlers plus a random sample equivalent to 5 percent of the final TAB report data as directed by Commissioning Authority.

1. Original TAB agency shall execute the re-checks, witnessed by the Commissioning Authority.
2. Use the same test instruments as used in the original TAB work.
3. Failure of more than 10 percent of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.
4. For purposes of re-check, failure is defined as follows:
    a. Air Flow of Supply and Return: Deviation of more than 10 percent of instrument reading.
    b. Minimum Outside Air Flow: Deviation of more than 20 percent of instrument reading; for inlet vane or VFD OSA compensation system using linear proportional control, deviation of more than 30 percent at intermediate supply flow.
    c. Temperatures: Deviation of more than one degree F.
    d. Air and Water Pressures: Deviation of more than 10 percent of full scale of test instrument reading.
    e. Sound Pressures: Deviation of more than 3 decibels, with consideration for variations in background noise.
5. For purposes of re-check, a whole system is defined as one in which inaccuracies will have little or no impact on connected systems; for example, the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system.

E. In the presence of the Commissioning Authority, verify that:
1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.
2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.
3. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.

F. No seasonal tests are required.

G. No further monitoring is required.

H. No deferred testing is required.

3.08 SCOPE

A. Test, adjust, and balance the following:
1. Air Cooled Refrigerant Condensers
2. Terminal Heat Transfer Units
3. Air Handling Units/Rooftop Mounted Air handling units/Rooftop Mounted Energy Recovery Ventilators
4. Fans
5. Air Filters
6. Air Inlets and Outlets

3.09 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
1. Manufacturer
2. Model/Frame
3. HP/BHP

4. Phase, voltage, amperage; nameplate, actual, no load
5. RPM
6. Service factor
7. Starter size, rating, heater elements
8. Sheave Make/Size/Bore

B. V-Belt Drives:
1. Identification/location
2. Required driven RPM
3. Driven sheave, diameter and RPM
4. Belt, size and quantity
5. Motor sheave diameter and RPM
6. Center to center distance, maximum, minimum, and actual

C. Air Cooled Condensers:
1. Identification/number
2. Location
3. Manufacturer
4. Model number
5. Serial number
6. Entering DB air temperature, design and actual
7. Leaving DB air temperature, design and actual
8. Number of compressors

D. Cooling Coils:
1. Identification/number
2. Location
3. Service
4. Manufacturer
5. Air flow, design and actual
6. Entering air DB temperature, design and actual
7. Entering air WB temperature, design and actual
8. Leaving air DB temperature, design and actual
9. Leaving air WB temperature, design and actual
10. Water flow, design and actual
11. Water pressure drop, design and actual
12. Entering water temperature, design and actual
13. Leaving water temperature, design and actual
14. Saturated suction temperature, design and actual
15. Air pressure drop, design and actual

E. Heating Coils:
1. Identification/number
2. Location
3. Service
4. Manufacturer
5. Air flow, design and actual
6. Water flow, design and actual
7. Water pressure drop, design and actual
8. Entering water temperature, design and actual
9. Leaving water temperature, design and actual
10. Entering air temperature, design and actual
11. Leaving air temperature, design and actual
12. Air pressure drop, design and actual

F. Air Moving Equipment:
1. Location

2. Manufacturer
3. Model number
4. Serial number
5. Arrangement/Class/Discharge
6. Air flow, specified and actual
7. Return air flow, specified and actual
8. Outside air flow, specified and actual
9. Total static pressure (total external), specified and actual
10. Inlet pressure
11. Discharge pressure
12. Sheave Make/Size/Bore
13. Number of Belts/Make/Size
14. Fan RPM

G. Return Air/Outside Air:
1. Identification/location
2. Design air flow
3. Actual air flow
4. Design return air flow
5. Actual return air flow
6. Design outside air flow
7. Actual outside air flow
8. Return air temperature
9. Outside air temperature
10. Required mixed air temperature
11. Actual mixed air temperature
12. Design outside/return air ratio
13. Actual outside/return air ratio

H. Duct Traverses:
1. System zone/branch
2. Duct size
3. Area
4. Design velocity
5. Design air flow
6. Test velocity
7. Test air flow
8. Duct static pressure
9. Air temperature
10. Air correction factor

I. Duct Leak Tests:
1. Description of ductwork under test
2. Duct design operating pressure
3. Duct design test static pressure
4. Duct capacity, air flow
5. Maximum allowable leakage duct capacity times leak factor
6. Test apparatus
    a. Blower
    b. Orifice, tube size
    c. Orifice size
    d. Calibrated
7. Test static pressure
8. Test orifice differential pressure
9. Leakage

J. Terminal Unit Data:

1. Manufacturer
2. Type, constant, variable, single, dual duct
3. Identification/number
4. Location
5. Model number
6. Size
7. Minimum static pressure
8. Minimum design air flow
9. Maximum design air flow
10. Maximum actual air flow
11. Inlet static pressure

K. Air Distribution Tests:
1. Air terminal number
2. Room number/location
3. Terminal type
4. Terminal size
5. Area factor
6. Design velocity
7. Design air flow
8. Test (final) velocity
9. Test (final) air flow
10. Percent of design air flow

L. Sound Level Reports:
1. Location
2. Octave bands - equipment off
3. Octave bands - equipment on

M. Vibration Tests:
1. Location of points:
    a. Fan bearing, drive end
    b. Fan bearing, opposite end
    c. Motor bearing, center (if applicable)
    d. Motor bearing, drive end
    e. Motor bearing, opposite end
    f. Casing (bottom or top)
    g. Casing (side)
    h. Duct after flexible connection (discharge)
    i. Duct after flexible connection (suction)
2. Test readings:
    a. Horizontal, velocity and displacement
    b. Vertical, velocity and displacement
    c. Axial, velocity and displacement
3. Normally acceptable readings, velocity and acceleration
4. Unusual conditions at time of test
5. Vibration source (if non-complying)

END OF SECTION 23 05 93

SECTION 23 07 13
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Insulation jackets.

1.02 RELATED REQUIREMENTS

A. Section 22 05 53 - Identification for Plumbing Piping and Equipment.

B. Section 23 05 53 - Identification for HVAC Piping and Equipment.

C. Section 23 31 00 - HVAC Ducts and Casings

1.03 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

D. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

E. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

F. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

I. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

J. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association.

K. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible.

L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experienceand approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:
   1. Knauf Insulation: www.knaufusa.com.
   2. Johns Manville Corporation: www.jm.com/#sle.
   3. Owens Corning Corp: www.owenscorning.com/#sle.
   4. CertainTeed Corporation: www.certainteed.com/#sle.

B. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. Minimum "R" Value: Minimum R value of (6) is required for interior installations and a minimum R value of (8) is required for exterior installations.
   2. Maximum Service Temperature: 450 degrees F.
   3. Maximum Water Vapor Sorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:
   1. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
   2. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Outdoor Vapor Barrier Mastic:
   1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

F. Tie Wire: Annealed steel, 16 gage.

2.03 GLASS FIBER, RIGID

A. Manufacturer:
   1. Knauf Insulation: www.knaufusa.com.
   2. Johns Manville Corporation: www.jm.com/#sle.
   3. Owens Corning Corp: www.owenscorning.com.
   4. CertainTeed Corporation: www.certainteed.com/#sle.

B. Insulation: ASTM C612; rigid, noncombustible blanket.
   1. Minimum "R" Value: Minimum R value of (6) is required for interior installations and a minimum R value of (8) is required for exterior installations.
   2. Maximum service temperature: 450 degrees F.
   3. Maximum Water Vapor Sorption: 5.0 percent.

C. Vapor Barrier Jacket:
   1. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
   2. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Indoor Vapor Barrier Finish:
   1. Cloth: Untreated; 9 oz/sq yd weight, glass fabric.

2. Vinyl emulsion type acrylic, compatible with insulation, black color.

2.04 JACKETS

A. Aluminum Jacket: ASTM B209 (ASTM B209M).
   1. Thickness: 0.016 inch sheet.
   2. Finish: Smooth.
   3. Joining: Longitudinal slip joints and 2 inch laps.
   4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.
   6. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated ducts conveying air below ambient temperature:
   1. Provide insulation with vapor barrier jackets.
   2. Finish with tape and vapor barrier jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Insulated ducts conveying air above ambient temperature:
   1. Provide with or without standard vapor barrier jacket.
   2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

E. Exterior Applications: Provide insulation with vapor barrier jacket. Cover with with calked aluminum jacket with seams located on bottom side of horizontal duct section.

F. External Duct Insulation Application:
   1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
   2. Secure insulation without vapor barrier with staples, tape, or wires.
   3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
   4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
   5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

3.03 SCHEDULES

A. INDOOR DUCT AND PLENUM APPLICATION SCHEDULE
   1. NOTE: Apply duct lagging where indicated on drawings.
   2. Service: Round, supply-air ducts, concealed.
      a. Material: Mineral-fiber blanket.
      b. Thickness: 2 inches.
      c. Minimum "R" value: 6.
      d. Jacket: Foil and paper.
      e. Vapor Retarder Required: Yes.
   3. Service: Round, return-air ducts, concealed.
      a. Material: Mineral-fiber blanket.
      b. Thickness: 2 inches.
      c. Minimum "R" value: 6.

d. Jacket: Foil and paper.
e. Vapor Retarder Required: No.

4. Service: Round, outside-air ducts, concealed.
   a. Material: Mineral-fiber blanket
   b. Thickness: 2 inches.
   c. Minimum "R" value: 6.
   d. Jacket: Foil and paper.
   e. Vapor Retarder Required: Yes.
5. Service: Rectangular, supply-air ducts, concealed.
   a. Material: Mineral-fiber blanket
   b. Thickness: 2 inches.
   c. Minimum "R" value: 6.
   d. Jacket: Foil and paper.
   e. Vapor Retarder Required: Yes.
   f. NOTE: Provide double-wall insulated ductwork where noted on drawings.
6. Service: Rectangular, return-air ducts, concealed.
   a. Material: Mineral-fiber blanket
   b. Thickness: 2 inches.
   c. Minimum "R" value: 6.
   d. Jacket: Foil and paper.
   e. Vapor Retarder Required: No.
   f. NOTE: Provide double-wall insulated ductwork where noted on drawings.
7. Service: Rectangular, outside-air ducts, concealed.
   a. Material: Mineral-fiber blanket
   b. Thickness: 2 inches.
   c. Minimum "R" value: 6.
   d. Jacket: Foil and paper.
   e. Vapor Retarder Required: Yes.
8. Service: Rectangular, range-hood exhaust ducts, concealed.
   a. Material: Calcium silicate.
   b. Thickness: 2 inches.
   c. Field-Applied Jacket: Glass cloth.
   d. Vapor Retarder Required: No.

B. OUTDOOR DUCT AND PLENUM APPLICATION SCHEDULE
1. Service: Round, supply-air ducts.
   a. Material: Mineral-fiber board.
   b. Thickness: 3 inches.
   c. Minimum "R" value: 8.
   d. Field-Applied Jacket: aluminum
      1) Aluminum Thickness: 0.032 inch
   e. Vapor Retarder Required: Yes.
2. Service: Round, return-air ducts.
   a. Material: Mineral-fiber board.
   b. Thickness: 3 inches.
   c. Minimum "R" value: 8.
   d. Field-Applied Jacket: aluminum
      1) Aluminum Thickness: 0.032 inch
   e. Vapor Retarder Required: Yes.
3. Service: Rectangular, supply-air ducts.
   a. Material: Mineral-fiber board.
   b. Thickness: 3 inches.
   c. Minimum "R" value: 8.
   d. Field-Applied Jacket: aluminum
      1) Aluminum Thickness: 0.032 inch

e. Vapor Retarder Required: Yes.

4. Service: Rectangular, return-air ducts.
   a. Material: Mineral-fiber board.
   b. Thickness: 3 inches.
   c. Minimum "R" value: 8.
   d. Field-Applied Jacket: aluminum
      1) Aluminum Thickness: 0.032 inch
   e. Vapor Retarder Required: Yes.

END OF SECTION 23 07 13

SECTION 23 07 19
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 23 23 00 - Refrigerant Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

D. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

E. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.

F. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.

G. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

H. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.

I. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

J. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.

K. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.

L. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

M. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing.

N. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.

O. ASTM C610 - Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation.

P. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

Q. ASTM D1056 - Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.

R. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.

S. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

T. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

U. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association.

V. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

2.02 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   1. Armacell International: www.armacell.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534 Grade 3; use molded tubular material wherever possible.
   1. Minimum Service Temperature: -40 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.03 JACKETS

A. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
   1. Thickness: 0.016 inch sheet.
   2. Finish: Smooth.
   3. Joining: Longitudinal slip joints and 2 inch laps.
   4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.
   6. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

G. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

H. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

I. Inserts and Shields:
   1. Application: Piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert location: Between support shield and piping and under the finish jacket.
   4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.

K. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

L. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.

M. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

N. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.03 SCHEDULE

A. PIPING INSULATION SCHEDULES
   1. General: Abbreviations used in the following schedules include:
      a. Field Applied Jackets: P - PVC, K-Foil and Paper, A - Aluminum, SS - Stainless Steel.
      b. Piping Sizes: NPS - Nominal Pipe Size.

B. INTERIOR PIPING APPLICATION SCHEDULE
   1. Service: Condensate drain piping.
      a. Operating Temperature: 35 to 75 deg F.

b. Insulation Material: Flexible elastomeric.
c. Insulation Thickness: 0.5 inch.
d. Jacket: None.
e. Vapor Retarder Required: Yes.
f. Finish: None.

2. Service: Refrigerant suction and hot-gas piping.
   a. Operating Temperature: 35 to 140 deg F.
   b. Insulation Material: Flexible elastomeric.
   c. Insulation Thickness: Apply the following insulation thicknesses:
      1) Pipe, 1” or less: 1.0 inch.
      2) Pipe, 1-1/4” and up: 1.5 inch.
   d. Jacket: None.
   e. Vapor Retarder Required: No.
   f. Finish: None.

C. EXTERIOR PIPING INSULATION APPLICATION SCHEDULE
   1. Service: Refrigerant suction.
      a. Operating Temperature: 35 to 140 deg F.
      b. Insulation Material: Flexible elastomeric.
      c. Insulation Thickness: Apply the following insulation thicknesses:
         1) Pipe, 1” or less: 1.0 inch.
         2) Pipe, 1-1/4” to 2”: 1.5 inch.
         3) Pipe, 2-1/2” and up: 1.5 inch.
      d. Jacket: Aluminum.
      e. Vapor Retarder Required: Yes.
      f. Finish: None.

END OF SECTION 23 07 19

SECTION 23 08 00

COMMISSIONING OF HVAC

PART 1 GENERAL

1.01 SUMMARY

A. This section covers the Owners Project Manager's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

B. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Owners Project Manager's use.

C. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:
   1. Control system.
   2. Major and minor equipment items.
   3. Piping systems and equipment.
   4. Ductwork and accessories.
   5. Terminal units.
   6. Variable frequency drives.
   7. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.
   8. Indoor Air Quality Procedures: The Commissioning Authority will coordinate; Contractor will execute; see Section 01 57 19.

D. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.02 SUBMITTALS

A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. Draft Prefunctional Checklists and Functional Test Procedures for Control System: Detailed written plan indicating the procedures to be followed to test, checkout and adjust the control system prior to full system Functional Testing; include at least the following for each type of equipment controlled:
   1. System name.
   2. List of devices.
   3. Step-by-step procedures for testing each controller after installation, including:
      a. Process of verifying proper hardware and wiring installation.
      b. Process of downloading programs to local controllers and verifying that they are addressed correctly.
      c. Process of performing operational checks of each controlled component.
      d. Plan and process for calibrating valve and damper actuators and all sensors.
      e. Description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.
   4. Copy of proposed log and field checkout sheets to be used to document the process; include space for initial and final read values during calibration of each point and space to specifically indicate when a sensor or controller has “passed” and is operating within the contract parameters.
   5. Description of the instrumentation required for testing.
   6. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the Commissioning Authority and TAB contractor for this determination.

C. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.

D. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:
   1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
   2. Full as-built set of control drawings.
   3. Full as-built sequence of operations for each piece of equipment.
   4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
      a. Floor.
      b. Room number.
      c. Room name.
      d. Air handler unit ID.
      e. Reference drawing number.
      f. Air terminal unit tag ID.
      g. Heating and/or cooling valve tag ID.
      h. Minimum air flow rate.
      i. Maximum air flow rate.
   5. Full print out of all schedules and set points after testing and acceptance of the system.
   6. Full as-built print out of software program.
   7. Electronic copy on disk of the entire program for this facility.
   8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
   9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
   10. Control equipment component submittals, parts lists, etc.
   11. Warranty requirements.
   12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
   13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
      a. Sequences of operation.
      b. Control drawings.
      c. Points lists.
      d. Controller and/or module data.
      e. Thermostats and timers.
      f. Sensors and DP switches.
      g. Valves and valve actuators.
      h. Dampers and damper actuators.
      i. Program setups (software program printouts).

E. Project Record Documents: See Section 01 78 00 for additional requirements.
   1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
   2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.

F. Draft Training Plan: In addition to requirements specified in Section 01 79 00, include:
   1. Follow the recommendations of ASHRAE Guideline 1.1.
   2. Control system manufacturer's recommended training.
   3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.

G. Training Manuals: See Section 01 79 00 for additional requirements.
   1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of North Providence School Department.

B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to North Providence School Department; such equipment, tools, and instruments are to become the property of North Providence School Department.

PART 3 EXECUTION

3.01 PREPARATION

A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.

B. Furnish additional information requested by the Commissioning Authority.

C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.

D. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.

E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.

F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.

G. Provide temperature and pressure taps in accordance with Contract Documents.

3.02 INSPECTING AND TESTING - GENERAL

A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.

B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.

C. Provide two-way radios for use during the testing.

D. Valve/Damper Stroke Setup and Check:
   1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
   2. Set pump/fan to normal operating mode.
   3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
   4. Command valve/damper open; verify position is full open and adjust output signal as required.
   5. Command valve/damper to a few intermediate positions.
   6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

E. Isolation Valve or System Valve Leak Check: For valves not by coils.

1. With full pressure in the system, command valve closed.
2. Use an ultra-sonic flow meter to detect flow or leakage.

F. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to North Providence School Department.

3.03 TAB COORDINATION

A. TAB: Testing, adjusting, and balancing of HVAC.

B. Coordinate commissioning schedule with TAB schedule.

C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.

D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.

E. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.

F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.04 CONTROL SYSTEM FUNCTIONAL TESTING

A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of Contract Documents and the detailed Sequences of Operation documentation submittal.

B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with Contract Documents.

C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.

D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.
1. The scope of trend logging is partially specified; trend log up to 50 percent more points than specified at no extra cost to North Providence School Department.
2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.

E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.

F. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.
1. Setpoint changing features and functions.
2. Sensor calibrations.

G. Demonstrate to the Commissioning Authority:
1. That all specified functions and features are set up, debugged and fully operable.
2. That scheduling features are fully functional and setup, including holidays.
3. That all graphic screens and value readouts are completed.
4. Correct date and time setting in central computer.
5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to North Providence School Department.
6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if

any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to North Providence School Department.

7. Power failure and battery backup and power-up restart functions.
8. Global commands features.
9. Security and access codes.
10. Occupant over-rides (manual, telephone, key, keypad, etc.).
11. O&M schedules and alarms.
12. Occupancy sensors and controls.
13. All control strategies and sequences not tested during controlled equipment testing.

H. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to North Providence School Department.

3.05 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 78 00 for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to North Providence School Department.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to North Providence School Department.

3.06 DEMONSTRATION AND TRAINING

A. See Section 01 79 00 for additional requirements.

B. Demonstrate operation and maintenance of HVAC system to North Providence School Department' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

C. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.

D. Provide classroom and hands-on training of North Providence School Department's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned. Provide the following minimum durations of training:

E. TAB Review: Instruct North Providence School Department's personnel for minimum 2 hours, after completion of TAB, on the following:

1. Review final TAB report, explaining the layout and meanings of each data type.
2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
5. Other salient information that may be useful for facility operations, relative to TAB.

F. HVAC Control System Training: Perform training in at least three phases:

1. Phase 1 - Basic Control System: Provide minimum of 8 hours of actual training on the control system itself. Upon completion of training, each attendee, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
    a. This training may be held on-site or at the manufacturer's facility.

b. If held off-site, the training may occur prior to final completion of the system installation.
c. For off-site training, Owners Project Manager shall pay expenses of up to two attendees.

2. Phase 2 - Integrating with HVAC Systems: Provide minimum of 8 hours of on-site, hands-on training after completion of Functional Testing. Include instruction on:
   a. The specific hardware configuration of installed systems in this facility and specific instruction for operating the installed system, including interfaces with other systems, if any.
   b. Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
   c. Trend logging and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends; provide practice in setting up trend logging and monitoring during training session.
   d. Every display screen, allowing time for questions.
   e. Point database entry and modifications.
3. Phase 3 - Post-Occupancy: Six months after occupancy conduct minimum of 4 hours of training. Tailor training session to questions and topics solicited beforehand from North Providence School Department. Also be prepared to address topics brought up and answer questions concerning operation of the system.

G. Provide the services of manufacturer representatives to assist instructors where necessary.

H. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

END OF SECTION 23 08 00

SECTION 23 09 13

INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Input/Output Sensors:
   1. Temperature sensors.
   2. Equipment operation (current) sensors.

B. Miscellaneous accessories.

1.02 RELATED REQUIREMENTS

A. Section 23 33 00 - Air Duct Accessories: Installation of automatic dampers.

B. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

C. Section 23 09 23 - Direct-Digital Control System for HVAC.

D. Section 23 09 93 - Sequence of Operations for HVAC Controls.

1.03 REFERENCE STANDARDS

A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating.

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

C. ASTM B32 - Standard Specification for Solder Metal.

D. ASTM B88 - Standard Specification for Seamless Copper Water Tube.

E. ASTM D1693 - Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association.

G. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

D. Manufacturer's Instructions: Provide for all manufactured components.

E. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.
   1. Revise shop drawings to reflect actual installation and operating sequences.

F. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

G. Warranty: Submit manufacturers warranty and ensure forms have been filled out in North Providence School Department s name and registered with manufacturer.

H. Maintenance Materials: Furnish the following for North Providence School Department's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this work and licensed in Rhode Island.

PART 2 PRODUCTS

2.01 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.02 INPUT/OUTPUT SENSORS

A. Temperature Sensors:
   1. Sensor range shall provide a resolution of no worse than .4°F (unless noted otherwise).
   2. Room temperature sensor shall be an element contained within a ventilated cover, suitable for wall mounting with digital output. Sensors located in mechanical areas, plenums, garages, gymnasiums, or corridors shall be a flat plate sensor with no possible adjustment or shall be provided with aestetically-pleasing lockable protective cover. Security screws shall be used in institutional settings as deemed necessary by the design engineer. ATC contractor shall coordinate requirements with the design engineer during the submittal process. Provide insulated base. Following sensing elements are acceptable:
      a. Sensing element - Platinum RTD, Thermistor, or integrated circuit, +/- 0.8°F accuracy at calibration point.
      b. Units shall be capable of +/- 2 degrees (F) adjustment by the occupant, with display showing current temperature and setpoint.
   3. Single point duct temperature sensor shall consist of sensing element, junction box for wiring connections and gasket to prevent air leakage or vibration noise. Temperature range as required for resolution indicated in paragraph A. Sensor probe shall be 316 stainless steel.
      a. Sensing element - Platinum RTD, Thermistor, or integrated circuit, +/- 0.8°F accuracy at calibration point.
   4. Averaging duct temperature sensor shall consist of an averaging element, junction box for wiring connections and gasket to prevent air leakage. Provide enough sensors to give one lineal foot of sensing element for each square foot of cooling coil face area. Temperature range as required for resolution indicated in paragraph A.
      a. Sensing element - Platinum RTD, Thermistor, or integrated circuit, +/- 0.8°F accuracy at calibration point.
   5. Liquid immersion temperature sensor shall include stainless steel thermowell, sensor and connection head for wiring connections.
      a. Sensing element for chilled water applications - Platinum RTD, Thermistor, or integrated circuit, +/- 0.8°F accuracy at calibration point. Temperature range shall be as required for resolution indicated in paragraph A.
      b. Sensing element for non-chilled water applications - Platinum RTD, +/- 0.2°F accuracy at calibration point. Temperature range shall be as required for resolution of no worse than 0.1°F.

B. Equipment Operation Sensors:
   1. Status Inputs for Fans: Differential pressure switch with adjustable range of 0 to 5 inches wg.
   2. Status Inputs for Electric Motors: Current sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.

2.03 THERMOSTATS

A. Line Voltage Thermostats:
   1. Integral manual On/Off/Auto selector switch, single or two pole as required.
   2. Dead band: Maximum 2 degrees F.
   3. Cover: Locking with set point adjustment, with thermometer.
   4. Rating: Motor load.

B. Outdoor Reset Thermostat:
   1. Remote bulb or bimetal rod and tube type, proportioning action with adjustable throttling range, adjustable setpoint.

2. Scale range: -10 to 70 degrees F.

C. Immersion Thermostat:
   1. Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint and adjustable throttling range.

D. Airstream Thermostats:
   1. Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint in middle of range and adjustable throttling range.
   2. Averaging service remote bulb element: 7.5 feet.

E. Electric Low Limit Duct Thermostat:
   1. Snap acting, single pole, single throw, manual reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below setpoint,
   2. Bulb length: Minimum 20 feet.
   3. Provide one thermostat for every 20 sq ft of coil surface.

F. Electric High Limit Duct Thermostat:
   1. Snap acting, single pole, single throw, manual reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or above setpoint,
   2. Bulb length: Minimum 20 feet.
   3. Provide one thermostat for every 20 sq ft of coil surface.

G. Fire Thermostats:
   1. UL labeled, factory set in accordance with NFPA 90A.
   2. Normally closed contacts, manual reset.

H. Heating/Cooling Valve Top Thermostats:
   1. Proportional acting for proportional flow, molded rubber diaphragm, remote bulb liquid filled element, direct and reverse acting at differential pressure to 25 psig, cast housing with position indicator and adjusting knob.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that systems are ready to receive work.

C. Beginning of installation means installer accepts existing conditions.

D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

F. Ensure installation of components is complementary to installation of similar components.

G. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check and verify location of thermostats with plans and room details before installation. Locate 48 inches above floor. Align with lighting switches, CO2 sensors, and humidistats. Refer to Section 26 27 26.

C. Mount freeze protection thermostats using flanges and element holders.

D. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.

E. Provide separable sockets for liquids and flanges for air bulb elements.

F. Provide thermostats in aspirating boxes in front entrances.

G. Provide guards on thermostats in entrances.

H. Provide valves with position indicators and with pilot positioners where sequenced with other controls.

I. Provide isolation (two position) dampers of parallel blade construction.

J. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.

K. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

L. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.

M. Provide conduit and electrical wiring in accordance with Section 26 27 17. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

N. Install pressure independent balancing and control valves for small terminal units on the supply or return lines of coils.

1. For accuracy in flow measurements try to avoid mounting taps and pumps immediately before or after the valve. A minimum distance of five times the pipe diameter and ten times the pipe diameter before the valve for taps and pump respectively is recommended before the valve. A minimum distance of two times the pipe diameter is recommended after the valve.
2. The actuator for the combined manual balancing and control valves for small terminal units can be installed in any position as per manufacturer’s recommendations.
3. Install in accordance with manufacturer’s instructions.

3.03 MAINTENANCE

A. See Section 01 70 00 - Execution Requirements, for additional requirements relating to maintenance service.

B. Provide service and maintenance of control system for one year from Date of Substantial Completion.

END OF SECTION 23 09 13

SECTION 23 09 23

DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. System Description

B. Operator Interface

C. Controllers

D. Power Supplies and Line Filtering

E. System Software

F. Controller Software

G. HVAC Control Programs

H. Control equipment.

I. Software.

1.02 RELATED REQUIREMENTS

A. Section 28 46 00 - Fire Detection and Alarm.

B. Section 23 09 13 - Instrumentation and Control Devices for HVAC.

C. Section 23 09 93 - Sequence of Operations for HVAC Controls.

D. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code.

1.04 SYSTEM DESCRIPTION

A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units .

B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

C. Include computer software and all hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

D. Controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, and the like when directly connected to the control units. Individual terminal unit control is specified in Section 23 09 13.

E. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment, power transformers and electrical feeds, and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

F. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for each system component and software module.

C. Shop Drawings:
   1. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.
   2. List connected data points, including connected control unit and input device.

3. Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations. Provide demonstration diskette containing graphics.
4. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
5. Indicate description and sequence of operation of operating, user, and application software.

D. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.

E. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
1. Revise shop drawings to reflect actual installation and operating sequences.
2. Include submittals data in final "Record Documents" form.

F. Operation and Maintenance Data:
1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

G. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in North Providence School Department s name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 70.

B. Design system software under direct supervision of a Professional Engineer experienced in design of this Work and licensed at Rhode Island.

C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum 10 years documented experience.

D. Installer Qualifications: Company specializing in performing the work of this section 5 years documented experience approved by manufacturer.

E. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.07 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this Section.

B. Require attendance of parties directly affecting the work of this Section.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Substantial Completion.

C. Provide five year manufacturer's warranty for field programmable micro-processor based units.

1.09 MAINTENANCE SERVICE

A. Provide service and maintenance of energy management and control systems for one years from Date of Substantial Completion.

B. Provide four complete inspections per year, two in each season, to inspect, calibrate, and adjust controls as required, and submit written reports.

C. Provide complete service of systems, including call backs. Make minimum of 4 complete normal inspections of approximately 4 hours duration in addition to normal service calls to inspect, calibrate, and adjust controls, and submit written reports.

1.10 EXTRA MATERIALS

A. See Section 01 60 00 - Product Requirements, for additional provisions.

1.11 PROTECTION OF SOFTWARE RIGHTS

A. Prior to delivery of software, the North Providence School Department and the party providing the software will enter into a software license agreement with provisions for the following:
   1. Limiting use of software to equipment provided under these specifications.
   2. Limiting copying.
   3. Preserving confidentiality.
   4. Prohibiting transfer to a third party.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Distech Controls by CTC Building Solutions to integate with the current Honeywell Niagra/Tridium platform.

B. Substitutions: Not Permitted.

2.02 SYSTEM DESCRIPTION

A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units with communications to existing Building Management System.

B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

C. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

D. Controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, and the like when directly connected to the control units. Individual terminal unit control is specified in Section 23 09 13.

E. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

F. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

2.03 CONTROLLERS

A. BUILDING LEVEL CONTROLLERS
   1. General:
      a. Manage global strategies by one or more, independent, standalone, microprocessor based controllers.
      b. Provide sufficient memory to support controller's operating system, database, and programming requirements.
      c. Share data between networked controllers.
      d. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
      e. Utilize real-time clock for scheduling.
      f. Continuously check processor status and memory circuits for abnormal operation.
      g. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
      h. Communication with other network devices to be based on assigned protocol.
   2. Communication:
      a. Controller to reside on a BACnet network using ISO 8802-3 (ETHERNET) Data Link/Physical layer protocol.

b. Perform routing when connected to a network of custom application and application specific controllers.
c. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.

3. Anticipated Environmental Ambient Conditions:
   a. Outdoors and/or in Wet Ambient Conditions:
      1) Mount within waterproof enclosures.
      2) Rated for operation at 40 to 150 degrees F.
   b. Conditioned Space:
      1) Mount within dustproof enclosures.
      2) Rated for operation at 32 to 120 degrees F.
4. Provisions for Serviceability:
   a. Diagnostic LEDs for power, communication, and processor.
   b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
6. Power and Noise Immunity:
   a. Maintain operation at 90 to 110 percent of nominal voltage rating.
   b. Perform orderly shutdown below 80 percent of nominal voltage.
   c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

B. INPUT/OUTPUT INTERFACE
1. Hardwired inputs and outputs tie into the DDC system through building, custom application, or application specific controllers.
2. All Input/Output Points:
   a. Protect controller from damage resulting from any point short-circuiting or grounding and from voltage up to 24 volts of any duration.
   b. Provide universal type for building and custom application controllers where input or output is software designated as either binary or analog type with appropriate properties.
3. Binary Inputs:
   a. Allow monitoring of On/Off signals from remote devices.
   b. Provide wetting current of 12 mA minimum, compatible with commonly available control devices and protected against the effects of contact bounce and noise.
   c. Sense dry contact closure with power provided only by the controller.
4. Pulse Accumulation Input Objects: Conform to all requirements of binary input objects and accept up to 10 pulses per second.
5. Analog Inputs:
   a. Allow for monitoring of low voltage 0 to 10 VDC, 4 to 20 mA current, or resistance signals (thermistor, RTD).
   b. Compatible with and field configurable to commonly available sensing devices.
6. Binary Outputs:
   a. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.
   b. Outputs provided with three position (On/Off/Auto) override switches.
   c. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.
7. Analog Outputs:
   a. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.
   b. Provide status lights and two position (AUTO/MANUAL) switch for building and custom application controllers with manually adjustable potentiometer for manual override on building and custom application controllers.

c. Drift to not exceed 0.4 percent of range per year.

8. Tri State Outputs:
   a. Coordinate two binary outputs to control three point, floating type, electronic actuators without feedback.
   b. Limit the use of three point, floating devices to the following zone and terminal unit control applications:
      1) VAV or duct terminal units.
      2) Duct mounted heating coils.
      3) Zone dampers.
      4) Radiation.
   c. Control algorithms run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.
9. System Object Capacity:
   a. System size to be expandable to twice the number of input output objects required by providing additional controllers, including associated devices and wiring.
   b. Hardware additions or software revisions for the installed operator interfaces are not to be required for future, system expansions.

2.04 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies:
   1. Provide UL listed control transformers with Class 2 current limiting type or over-current protection in both primary and secondary circuits for Class 2 service as required by the NEC.
   2. Limit connected loads to 80 percent of rated capacity.
   3. Match DC power supply to current output and voltage requirements.
   4. Unit to be full wave rectifier type with output ripple of 5.0 mV maximum peak to peak.
   5. Regulation to be 1 percent combined line and load with 100 microsecond response time for 50 percent load changes.
   6. Provide over-voltage and over-current protection to withstand a 150 percent current overload for 3 seconds minimum without trip-out or failure.
   7. Operational Ambient Conditions: 32 to 120 degrees F.
   8. EM/RF meets FCC Class B and VDE 0871 for Class B and MIL-STD 810 for shock and vibration.
   9. Line voltage units UL recognized and CSA approved.

B. Power Line Filtering:
   1. Provide external or internal transient voltage and surge suppression component for all workstations and controllers.
   2. Minimum surge protection attributes:
      a. Dielectric strength of 1000 volts minimum.
      b. Response time of 10 nanoseconds or less.
      c. Transverse mode noise attenuation of 65 dB or greater.
      d. Common mode noise attenuation of 150 dB or greater at 40 to 100 Hz.

2.05 OPERATOR STATION

A. Work Station:
   1. Utilize owner-provided mobile laptop for interface.

B. System Support: Minimum ten (10) work stations connected to multi-user, multi-tasking environment with concurrent capability to:
   1. Access DDC network.
   2. Access or control same control unit.
   3. Access or modify same control unit data base.
   4. Archive data, alarms, and network actions to hard disk regardless of what application programs are being currently executed.
   5. Develop and edit data base.
   6. Implement and tune DDC control.

7. Develop graphics.
8. Control facility.

2.06 CONTROL UNITS

A. Units: Modular in design and consisting of processor board with programmable RAM memory, local operator access and display panel, and integral interface equipment.

B. Battery Backup: For minimum of 48 hours for complete system including RAM without interruption, with automatic battery charger.

C. Control Units Functions:
   1. Monitor or control each input/output point.
   2. Completely independent with hardware clock/calendar and software to maintain control independently.
   3. Acquire, process, and transfer information to operator station or other control units on network.
   4. Accept, process, and execute commands from other control unit's or devices or operator stations.
   5. Access both data base and control functions simultaneously.
   6. Record, evaluate, and report changes of state or value that occur among associated points. Continue to perform associated control functions regardless of status of network.
   7. Perform in stand-alone mode:
      a. Start/stop.
      b. Duty cycling.
      c. Automatic Temperature Control.
      d. Demand control via a sliding window, predictive algorithm.
      e. Event initiated control.
      f. Calculated point.
      g. Scanning and alarm processing.
      h. Full direct digital control.
      i. Trend logging.
      j. Global communications.
      k. Maintenance scheduling.

D. Global Communications:
   1. Broadcast point data onto network, making that information available to all other system control units.
   2. Transmit any or all input/output points onto network for use by other control units and utilize data from other control units.

E. Input/Output Capability:
   1. Discrete/digital input (contact status).
   2. Discrete/digital output.
   3. Analog input.
   4. Analog output.
   5. Pulse input (5 pulses/second).
   6. Pulse output (0-655 seconds in duration with 0.01 second resolution).

F. Monitor, control, or address data points. Mix shall include analog inputs, analog outputs, pulse inputs, pulse outputs and discrete inputs/outputs, as required. Install control unit's with minimum 30 percent spare capacity.

G. Point Scanning: Set scan or execution speed of each point to operator selected time from 1 to 250 seconds.

H. Upload/Download Capability: Download from or upload to operator station. Upload/Download time for entire control unit database maximum 10 seconds on hard wired LAN, or 60 seconds over voice grade phone lines.

I. Test Mode Operation: Place input/output points in test mode to allow testing and developing of control algorithms on line without disrupting field hardware and controlled environment. In test mode:
   1. Inhibit scanning and calculation of input points. Issue manual control to input points (set analog or digital input point to operator determined test value) from work station.
   2. Control output points but change only data base state or value; leave external field hardware unchanged.
   3. Enable control actions on output points but change only data base state or value.

J. Local display and adjustment panel: Portable control unit, containing digital display, and numerical keyboard. Display and adjust:
   1. Input/output point information and status.
   2. Controller set points.
   3. Controller tuning constants.
   4. Program execution times.
   5. High and low limit values.
   6. Limit differential.
   7. Set/display date and time.
   8. Control outputs connected to the network.
   9. Automatic control outputs.
   10. Perform control unit diagnostic testing.
   11. Points in "Test" mode.

2.07 LOCAL AREA NETWORK (LAN)

A. Provide communication between control units over local area network (LAN).

B. LAN Capacity: Not less than 100 stations or nodes.

C. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.

D. LAN Data Speed: Minimum 19.2 Kb.

E. Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.

F. Transmission Median: Fiber optic or single pair of solid 24 gauge twisted, shielded copper cable.

G. Network Support: Time for global point to be received by any station, shall be less than 3 seconds. Provide automatic reconfiguration if any station is added or lost. If transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

2.08 SYSTEM SOFTWARE

A. Operating System:
   1. Concurrent, multi-tasking capability.
      a. Common Software Applications Supported: Microsoft Excel.
   2. System Graphics:
      a. Allow up to 10 graphic screens, simultaneously displayed for comparison and monitoring of system status.
      b. Animation displayed by shifting image files based on object status.
      c. Provide method for operator with password to perform the following:
         1) Move between, change size, and change location of graphic displays.
         2) Modify on-line.
         3) Add, delete, or change dynamic objects consisting of:
            (a) Analog and binary values.
            (b) Dynamic text.
            (c) Static text.
            (d) Animation files.
   3. Custom Graphics Generation Package:

a. Create, modify, and save graphic files and visio format graphics in PCX formats.
b. HTML graphics to support web browser compatible formats.
c. Capture or convert graphics from AutoCAD.

4. Standard HVAC Graphics Library:
   a. HVAC Equipment:
   b. Ancillary Equipment:

B. Workstation System Applications:
1. Automatic System Database Save and Restore Functions:
   a. Current database copy of each Building Controller is automatically stored on hard disk.
   b. Automatic update occurs upon change in any system panel.
   c. In the event of database loss in any system panel, the first workstation to detect the loss automatically restores the database for that panel unless disabled by the operator.
2. Manual System Database Save and Restore Functions by Operator with Password Clearance:
   a. Save database from any system panel.
   b. Clear a panel database.
   c. Initiate a download of a specified database to any system panel.
3. Software provided allows system configuration and future changes or additions by operators under proper password protection.
4. On-line Help:
   a. Context-sensitive system assists operator in operation and editing.
   b. Available for all applications.
   c. Relevant screen data provided for particular screen display.
   d. Additional help available via hypertext.
5. Security:
   a. Operator log-on requires user name and password to view, edit, add, or delete data.
   b. System security selectable for each operator.
   c. System supervisor sets passwords and security levels for all other operators.
   d. Operator passwords to restrict functions accessible to viewing and/or changing system applications, editor, and object.
   e. Automatic, operator log-off results from keyboard or mouse inactivity during user-adjustable, time period.
   f. All system security data stored in encrypted format.
6. System Diagnostics:
   a. Operations Automatically Monitored:
      1) Workstations.
      2) Printers.
      3) Modems.
      4) Network connections.
      5) Building management panels.
      6) Controllers.
   b. Device failure is annunciated to the operator.
7. Alarm Processing:
   a. All system objects are configurable to "alarm in" and "alarm out" of normal state.
   b. Configurable Objects:
      1) Alarm limits.
      2) Alarm limit differentials.
      3) States.
      4) Reactions for each object.
8. Alarm Messages:
   a. Descriptor: English language.
   b. Recognizable Features:

1) Source.
2) Location.
3) Nature.

9. Configurable Alarm Reactions by Workstation and Time of Day:
   a. Logging.
   b. Printing.
   c. Starting programs.
   d. Displaying messages.
   e. Dialing out to remote locations.
   f. Paging.
   g. Providing audible annunciation.
   h. Displaying specific system graphics.
10. Custom Trend Logs:
   a. Definable for any data object in the system including interval, start time, and stop time.
   b. Trend Data:
      1) Sampled and stored on the building controller panel.
      2) Archivable on hard disk.
      3) Retrievable for use in reports, spreadsheets and standard database programs.
      4) Archival on LAN accessible storage media including hard disk, tape, Raid array drive, and virtual cloud environment.
      5) Protected and encrypted format to prevent manipulation, or editing of historical data and event logs.
11. Alarm and Event Log:
   a. View all system alarms and change of states from any system location.
   b. Events listed chronologically.
   c. Operator with proper security acknowledges and clears alarms.
   d. Alarms not cleared by operator are archived to the workstation hard disk.
12. Object, Property Status and Control:
   a. Provide a method to view, edit if applicable, the status of any object and property in the system.
   b. Status Available by the Following Methods:
      1) Menu.
      2) Graphics.
      3) Custom Programs.
13. Reports and Logs:
   a. Reporting Package:
      1) Allows operator to select, modify, or create reports.
      2) Definable as to data content, format, interval, and date.
      3) Archivable to hard disk.
   b. Real-time logs available by type or status such as alarm, lockout, normal, etc.
   c. Stored on hard disk and readily accessible by standard software applications, including spreadsheets and word processing.
   d. Set to be printed on operator command or specific time(s).
14. Reports:
   a. Standard:
      1) Objects with current values.
      2) Current alarms not locked out.
      3) Disabled and overridden objects, points and SNVTs.
      4) Objects in manual or automatic alarm lockout.
      5) Objects in alarm lockout currently in alarm.
      6) Logs:
         (a) Alarm History.
         (b) System messages.

(c) System events.
(d) Trends.

b. Custom:
1) Daily.
2) Weekly.
3) Monthly.
4) Annual.
5) Time and date stamped.
6) Title.
7) Facility name.

c. Tenant Override:
1) Monthly report showing total, requested, after-hours HVAC and lighting services on a daily basis for each tenant.
2) Annual report showing override usage on a monthly basis.

d. Electrical, Fuel, and Weather:
1) Electrical Meter(s):
(a) Monthly showing daily electrical consumption and peak electrical demand with time and date stamp for each meter.
(b) Annual summary showing monthly electrical consumption and peak demand with time and date stamp for each meter.
2) Fuel Meter(s):
(a) Monthly showing daily natural gas consumption for each meter.
(b) Annual summary showing monthly consumption for each meter.
3) Weather:
(a) Monthly showing minimum, maximum, average outdoor air temperature and heating/cooling degree-days for the month.

C. Workstation Applications Editors:
1. Provide editing software for all system applications at the PC workstation.
2. Downloaded application is executed at controller panel.
3. Full screen editor for each application allows operator to view and change:
a. Configuration.
b. Name.
c. Control parameters.
d. Set-points.
4. Scheduling:
a. Monthly calendar indicates schedules, holidays, and exceptions.
b. Allows several related objects to be scheduled and copied to other objects or dates.
c. Start and stop times adjustable from master schedule.
5. Custom Application Programming:
a. Create, modify, debug, edit, compile, and download custom application programming during operation and without disruption of all other system applications.
b. Programming Features:
1) English oriented language, based on BASIC, FORTRAN, C, or PASCAL syntax allowing for free form programming.
2) Alternative language graphically based using appropriate function blocks suitable for all required functions and amenable to customizing or compounding.
3) Insert, add, modify, and delete custom programming code that incorporates word processing features such as cut/paste and find/replace.
4) Allows the development of independently, executing, program modules designed to enable and disable other modules.
5) Debugging/simulation capability that displays intermediate values and/or results including syntax/execution error messages.

6) Support for conditional statements (IF/THEN/ELSE/ELSE-F) using compound Boolean (AND, OR, and NOT) and/or relations (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.
7) Support for floating-point arithmetic utilizing plus, minus, divide, times, square root operators; including absolute value; minimum/maximum value from a list of values for mathematical functions.
8) Language consisting of resettable, predefined, variables representing time of day, day of the week, month of the year, date; and elapsed time in seconds, minutes, hours, and days where the variable values cab be used in IF/THEN comparisons, calculations, programming statement logic, etc.
9) Language having predefined variables representing status and results of the system software enables, disables, and changes the set points of the controller software.

2.09 CONTROLLER SOFTWARE

A. All applications reside and operate in the system controllers and editing of all applications occurs at the operator workstation.

B. System Security:
   1. User access secured via user passwords and user names.
   2. Passwords restrict user to the objects, applications, and system functions as assigned by the system manager.
   3. User Log On/Log Off attempts are recorded.
   4. Automatic Log Off occurs following the last keystroke after a user defined delay time.

C. Object or Object Group Scheduling:
   1. Weekly Schedules Based on Separate, Daily Schedules:
      a. Include start, stop, optimal stop, and night economizer.
      b. 10 events maximum per schedule.
      c. Start/stop times adjustable for each group object.

D. Provide standard application for equipment coordination and grouping based on function and location to be used for scheduling and other applications.

E. Alarms:
   1. Binary object is set to alarm based on the operator specified state.
   2. Analog object to have high/low alarm limits.
   3. All alarming is capable of being automatically and manually disabled.
   4. Alarm Reporting:
      a. Operator determines action to be taken for alarm event.
      b. Alarms to be routed to appropriate workstation.
      c. Reporting Options:

F. Maintenance Management: System monitors equipment status and generates maintenance messages based upon user-designated run-time limits.

G. Sequencing: Application software based upon specified sequences of operation in Section 23 09 93.

H. PID Control Characteristics:
   1. Direct or reverse action.
   2. Anti-windup.
   3. Calculated, time-varying, analog value, positions an output or stages a series of outputs.
   4. User selectable controlled variable, set-point, and PED gains.

I. Staggered Start Application:
   1. Prevents all controlled equipment from simultaneously restarting after power outage.
   2. Order of equipment startup is user selectable.

J. Energy Calculations:
   1. Accumulated instantaneous power or flow rates are converted to energy use data.

2. Algorithm calculates a rolling average and allows window of time to be user specified in minute intervals.
3. Algorithm calculates a fixed window average with a digital input signal from a utility meter defining the start of the window period that in turn synchronizes the fixed-window average with that used by the power company.

K. Anti-Short Cycling:
1. All binary output objects protected from short-cycling.
2. Allows minimum on-time and off-time to be selected.

L. On-Off Control with Differential:
1. Algorithm allows binary output to be cycled based on a controlled variable and set-point.
2. Algorithm to be direct-acting or reverse-acting incorporating an adjustable differential.

M. Run-Time Totalization:
1. Totalize run-times for all binary input objects.
2. Provides operator with capability to assign high run-time alarm.

2.10 OPERATING SYSTEM SOFTWARE

A. Input/Output Capability From Operator Station:
1. Request display of current values or status in tabular or graphic format.
2. Command selected equipment to specified state.
3. Initiate logs and reports.
4. Change analog limits.
5. Add, delete, or change points within each control unit or application routine.
6. Change point input/output descriptors, status, alarm descriptors, and engineering unit descriptors.
7. Add new control units to system.
8. Modify and set up maintenance scheduling parameters.
9. Develop, modify, delete or display full range of color graphic displays.
10. Automatically archive select data even when running third party software.
11. Provide capability to sort and extract data from archived files and to generate custom reports.
12. Support two printer operations.
    a. Alarm printer: Print alarms, operator acknowledgements, action messages, system alarms, operator sign-on and sign-off.
    b. Data printer: Print reports, page prints, and data base prints.
13. Select daily, weekly or monthly as scheduled frequency to synchronize time and date in digital control units. Accommodate daylight savings time adjustments.
14. Print selected control unit data base.

B. Operator System Access: Via software password with minimum 30 access levels at work station and minimum 3 access levels at each control unit.

C. Data Base Creation and Support: Changes shall utilize standard procedures. Control unit shall automatically check work station data base files upon connection and verify data base match. Minimum capability shall include:
1. Add and delete points.
2. Modify any point parameter.
3. Change, add, or delete English language descriptors.
4. Add, modify, or delete alarm limits.
5. Add, modify, or delete points in start/stop programs, trend logs, etc.
6. Create custom relationship between points.
7. Create or modify DDC loops and parameters.
8. Create or modify override parameters.
9. Add, modify, and delete any applications program.
10. Add, delete, develop, or modify dynamic color graphic displays.

D. Dynamic Color Graphic Displays:

1. Utilizes custom symbols or system supported library of symbols.
2. Sixteen (16) colors.
3. Sixty (60) outputs of real time, live dynamic data per graphic.
4. Dynamic graphic data.
5. 1,000 separate graphic pages.
6. Modify graphic screen refresh rate between 1 and 60 seconds.

E. Operator Station:
1. Accept data from LAN as needed without scanning entire network for updated point data.
2. Interrogate LAN for updated point data when requested.
3. Allow operator command of devices.
4. Allow operator to place specific control units in or out of service.
5. Allow parameter editing of control units.
6. Store duplicate data base for every control unit and allow down loading while system is on line.
7. Control or modify specific programs.
8. Develop, store and modify dynamic color graphics.
9. Provide data archiving of assigned points and support overlay graphing of this data utilizing up to four (4) variables.

F. Alarm Processing:
1. Off normal condition: Cause alarm and appropriate message, including time, system, point descriptor, and alarm condition. Select alarm state/value and which alarms shall cause automatic dial-out.
2. Critical alarm or change-of-state: Display message, stored on disk for review and sort, or print.
3. Print on line changeable message, up to 100 characters in length, for each alarm point specified.
4. Display alarm reports on video. Display multiple alarms in order of occurrence.
5. Define time delay for equipment start-up or shutdown.
6. Allow unique routing of specific alarms.
7. Operator specifies if alarm requires acknowledgement.
8. Continue to indicate unacknowledged alarms after return to normal.
9. Alarm notification:
    a. Automatic print.
    b. Display indicating alarm condition.
    c. Selectable audible alarm indication.

G. Event Processing: Automatically initiate commands, user defined messages, take specific control actions or change control strategy and application programs resulting from event condition. Event condition may be value crossing operator defined limit, change-of-state, specified state, or alarm occurrence or return to normal.

H. Automatic Restart: Automatically restart field equipment on restoration of power. Provide time delay between individual equipment restart and time of day start/stop.

I. Messages:
1. Automatically display or print user-defined message subsequent to occurrence of selected events.
2. Compose, change, or delete any message.
3. Display or log any message at any time.
4. Assign any message to any event.

J. Reports:
1. Manually requested with time and date.
2. Long term data archiving to hard disk.
3. Automatic directives to download to transportable media such as floppy diskettes for storage.
4. Data selection methods to include data base search and manipulation.

5. Data extraction with mathematical manipulation.
6. Data reports shall allow development of XY curve plotting, tabular reports (both statistical and summary), and multi-point timed based plots with not less than four (4) variables displayed.
7. Generating reports either normally at operator direction, or automatically under work station direction.
8. Reports may either manually displayed or printed, or may be printed automatically on daily, weekly, monthly, yearly or scheduled basis.
9. Include capability for statistical data manipulation and extraction.
10. Provide capability to generate four types of reports: Statistical detail reports, summary reports, trend graphic plots, x-y graphic plots.

K. Parameter Save/Restore: Store most current operating system, parameter changes, and modifications on disk or diskette.

L. Data Collection:
1. Automatically collect and store in disk files.
2. Daily electrical energy consumption, peak demand, and time of peak demand for up to electrical meters over 2 year period.
3. Daily consumption for up to 30 meters over a 2 year period.
4. Daily billable electrical energy consumption and time for up to 1024 zones over a 10 year period.
5. Provide archiving of stored data for use with system supplied custom reports.

M. Graphic Display: Support graphic development on work station with software features:
1. Page linking.
2. Generate, store, and retrieve library symbols.
3. Single or double height characters.
4. Sixty (60) dynamic points of data per graphic page.
5. Pixel level resolution.
6. Animated graphics for discrete points.
7. Analog bar graphs.
8. Display real time value of each input or output line diagram fashion.

N. Maintenance Management:
1. Run time monitoring, per point.
2. Maintenance scheduling targets with automatic annunciation, scheduling and shutdown.
3. Equipment safety targets.
4. Display of maintenance material and estimated labor.
5. Target point reset, per point.

O. Advisories:
1. Summary which contains status of points in locked out condition.
2. Continuous operational or not operational report of interrogation of system hardware and programmable control units for failure.
3. Report of power failure detection, time and date.
4. Report of communication failure with operator device, field interface unit, point, programmable control unit.

2.11 LOAD CONTROL PROGRAMS

A. General: Support inch-pounds and SI (metric) units of measurement.

B. Demand Limiting:
1. Monitor total power consumption per power meter and shed associated loads automatically to reduce power consumption to an operator set maximum demand level.
2. Input: Pulse count from incoming power meter connected to pulse accumulator in control unit.
3. Forecast demand (kW): Predicted by sliding window method.

4. Automatically shed loads throughout the demand interval selecting loads with independently adjustable on and off time of between one and 255 minutes.
5. Demand Target: Minimum of 3 per demand meter; change targets based upon (1) time, (2) status of pre-selected points, or (3) temperature.
6. Load: Assign load shed priority, minimum "ON" time and maximum "OFF" time.
7. Limits: Include control band (upper and lower limits).
8. Output advisory if loads are not available to satisfy required shed amount, advise shed requirements and requiring operator acknowledgement.

C. Duty Cycling:
1. Periodically stop and start loads, based on space temperature, and according to various On/Off patterns.
2. Modify off portion of cycle based on operator specified comfort parameters. Maintain total cycle time by increasing on portion of cycle by same amount that off portion is reduced.
3. Set and modify following parameters for each individual load.
   a. Minimum and maximum Off time.
   b. On/Off time in one minute increments.
   c. Time period from beginning of interval until load can be cycled.
   d. Manually override the DCC program and place a load in an On or Off state.
   e. Cooling Target Temperature and Differential.
   f. Heating Target Temperature and Differential.
   g. Cycle off adjustment.

D. Automatic Time Scheduling:
1. Self-contained programs for automatic start/stop/scheduling of building loads.
2. Support up to seven (7) normal day schedules, seven (7) "special day" schedules and two (2) temporary day schedules.
3. Special days schedule shall support up to 30 unique date/duration combinations.
4. Any number of loads assigned to any time program; each load can have individual time program.
5. Each load assigned at least 16 control actions per day with 1 minute resolution.
6. Time schedule operations may be:
   a. Start.
   b. Optimized Start.
   c. Stop.
   d. Optimized Stop.
   e. Cycle.
   f. Optimized Cycle.
7. Minimum of 30 holiday periods up to 100 days in length may be specified for the year.
8. Create temporary schedules.
9. Broadcast temporary "special day" date and duration.

E. Start/Stop Time Optimization:
1. Perform optimized start/stop as function of outside conditions, inside conditions, or both.
2. Adaptive and self-tuning, adjusting to changing conditions unattended.
3. For each point under control, establish and modify:
   a. Occupancy period.
   b. Desired temperature at beginning of occupancy period.
   c. Desired temperature at end of occupancy period.

F. Night Setback/Setup Program: Reduce heating space temperature setpoint or raise cooling space temperature setpoint during unoccupied hours; in conjunction with scheduled start/stop and optimum start/stop programs.

G. Calculated Points: Define calculations and totalization computed from monitored points (analog/digital points), constants, or other calculated points.
1. Employ arithmetic, algebraic, Boolean, and special function operations.

2. Treat calculated values like any other analog value, use for any function that a "hard wired point" might be used.

H. Event Initiated Programming: Event may be initiated by any data point, causing series of controls in a sequence.
   1. Define time interval between each control action between 0 to 3600 seconds.
   2. Output may be analog value.
   3. Provide for "skip" logic.
   4. Verify completion of one action before proceeding to next. If not verified, program shall be able to skip to next action.

I. Direct Digital Control: Each control unit shall provide Direct Digital Control software so that the operator may customize control strategies and sequences of operation by defining the appropriate control loop algorithms and choosing the optimum loop parameters.
   1. Control loops: Defined using "modules" that are analogous to standard control devices.
   2. Output: Paired or individual digital outputs for pulse-width modulation, and analog outputs, as required.
   3. Firmware:
      a. PID with analog or pulse-width modulation output.
      b. Floating control with pulse-width modulated outputs.
      c. Two-position control.
      d. Primary and secondary reset schedule selector.
      e. Hi/Lo signal selector.
      f. Single pole double throw relay.
      g. Single pole double throw time delay relay with delay before break, delay before make and interval time capabilities.
   4. Direct Digital Control loops: Downloaded upon creation or on operator request. On sensor failure, program shall execute user defined failsafe output.
   5. Display: Value or state of each of the lines which interconnect DDC modules.

J. Fine Tuning Direct Digital Control PID or floating loops:
   1. Display information:
      a. Control loop being tuned
      b. Input (process) variable
      c. Output (control) variable
      d. Setpoint of loop
      e. Proportional band
      f. Integral (reset) Interval
      g. Derivative (rate) Interval
   2. Display format: Graphic, with automatic scaling; with input and output variable superimposed on graph of "time" vs "variable".

K. Trend logging:
   1. Each control unit will store samples of control unit's data points.
   2. Update file continuously at discretely assignable intervals.
   3. Automatically initiate upload request and then store data on hard disk.
   4. Time synchronize sampling at operator specified times and intervals with sample resolution of one minute.
   5. Co-ordinate sampling with on/off state of specified point.
   6. Display trend samples on work station in graphic format. Automatically scale trend graph with minimum 60 samples of data in plot of time vs data.

2.12 HVAC CONTROL PROGRAMS

A. General:
   1. Support Inch-pounds and SI (metric) units of measurement.
   2. Identify each HVAC Control system.

B. Optimal Run Time:

1. Control start-up and shutdown times of HVAC equipment for both heating and cooling.
2. Base on occupancy schedules, outside air temperature, seasonal requirements, and interior room mass temperature.
3. Start-up systems by using outside air temperature, room mass temperatures, and adaptive model prediction for how long building takes to warm up or cool down under different conditions.
4. Use outside air temperature to determine early shut down with ventilation override.
5. Analyze multiple building mass sensors to determine seasonal mode and worse case condition for each day.
6. Operator commands:
    a. Define term schedule
    b. Add/delete fan status point.
    c. Add/delete outside air temperature point.
    d. Add/delete mass temperature point.
    e. Define heating/cooling parameters.
    f. Define mass sensor heating/cooling parameters.
    g. Lock/unlock program.
    h. Request optimal run time control summary.
    i. Request optimal run time mass temperature summary.
    j. Request HVAC point summary.
    k. Request HVAC saving profile summary.
7. Control Summary:
    a. HVAC Control system begin/end status.
    b. Optimal run time lock/unlock control status.
    c. Heating/cooling mode status.
    d. Optimal run time schedule.
    e. Start/Stop times.
    f. Selected mass temperature point ID.
    g. Optimal run time system normal start times.
    h. Occupancy and vacancy times.
    i. Optimal run time system heating/cooling mode parameters.
8. Mass temperature summary:
    a. Mass temperature point type and ID.
    b. Desired and current mass temperature values.
    c. Calculated warm-up/cool-down time for each mass temperature.
    d. Heating/cooling season limits.
    e. Break point temperature for cooling mode analysis.
9. HVAC point summary:
    a. Control system identifier and status.
    b. Point ID and status.
    c. Outside air temperature point ID and status.
    d. Mass temperature point ID and point.
    e. Calculated optimal start and stop times.
    f. Period start.

C. Supply Air Reset:
1. Monitor heating and cooling loads in building spaces, terminal reheat systems, both hot deck and cold deck temperatures on dual duct and multizone systems, single zone unit discharge temperatures.
2. Adjust discharge temperatures to most energy efficient levels satisfying measured load by:
    a. Raising cooling temperatures to highest possible value.
    b. Reducing heating temperatures to lowest possible level.
3. Operator commands:
    a. Add/delete fan status point.
    b. Lock/unlock program.

c. Request HVAC point summary.
d. Add/Delete discharge controller point.
e. Define discharge controller parameters.
f. Add/delete air flow rate.
g. Define space load and load parameters.
h. Request space load summary.

4. Control summary:
   a. HVAC control system status (begin/end).
   b. Supply air reset system status.
   c. Optimal run time system status.
   d. Heating and cooling loop.
   e. High/low limits.
   f. Deadband.
   g. Response timer.
   h. Reset times.
5. Space load summary:
   a. HVAC system status.
   b. Optimal run time status.
   c. Heating/cooling loop status.
   d. Space load point ID.
   e. Current space load point value.
   f. Control heat/cool limited.
   g. Gain factor.
   h. Calculated reset values.
   i. Fan status point ID and status.
   j. Control discharge temperature point ID and status.
   k. Space load point ID and status.
   l. Air flow rate point ID and status.

D. Enthalpy Switchover:
1. Calculate outside and return air enthalpy using measured temperature and relative humidity; determine energy expended and control outside and return air dampers.
2. Operator commands:
   a. Add/delete fan status point.
   b. Add/delete outside air temperature point.
   c. Add/delete discharge controller point.
   d. Define discharge controller parameters.
   e. Add/delete return air temperature point.
   f. Add/delete outside air dew point/humidity point.
   g. Add/delete return air dew point/humidity point.
   h. Add/delete damper switch.
   i. Add/delete minimum outside air.
   j. Add/delete atmospheric pressure.
   k. Add/delete heating override switch.
   l. Add/delete evaporative cooling switch.
   m. Add/delete air flow rate.
   n. Define enthalpy deadband.
   o. Lock/unlock program.
   p. Request control summary.
   q. Request HVAC point summary.
3. Control summary:
   a. HVAC control system begin/end status.
   b. Enthalpy switchover optimal system status.
   c. Optimal return time system status.
   d. Current outside air enthalpy.

e. Calculated mixed air enthalpy.
f. Calculated cooling cool enthalpy using outside air.
g. Calculated cooling cool enthalpy using mixed air.
h. Calculated enthalpy difference.
i. Enthalpy switchover deadband.
j. Status of damper mode switch.

2.13 PROGRAMMING APPLICATION FEATURES

A. Trend Point:
1. Sample up to 150 points, real or computed, with each point capable of collecting 100 samples at intervals specified in minutes, hours, days, or month.
2. Output trend logs as line graphs or bar graphs. Output graphic on terminal, with each point for line and bar graphs designated with a unique pattern, vertical scale either actual values or percent of range, and horizontal scale time base. Print trend logs up to 12 columns of one point/column.

B. Alarm Messages:
1. Allow definition of minimum of 100 messages, each having minimum length of 100 characters for each individual message.
2. Assign alarm messages to system messages including point's alarm condition, point's off-normal condition, totalized point's warning limit, hardware elements advisories.
3. Output assigned alarm with "message requiring acknowledgement".
4. Operator commands include define, modify, or delete; output summary listing current alarms and assignments; output summary defining assigned points.

C. Weekly Scheduling:
1. Automatically initiate equipment or system commands, based on preselected time schedule for points specified.
2. Provide program times for each day of week, per point, with one minute resolution.
3. Automatically generate alarm output for points not responding to command.
4. Provide for holidays, minimum of 366 consecutive holidays.
5. Operator commands:
a. System logs and summaries.
b. Start of stop point.
c. Lock or unlock control or alarm input.
d. Add, delete, or modify analog limits and differentials.
e. Adjust point operation position.
f. Change point operational mode.
g. Open or close point.
h. Enable/disable, lock/unlock, or execute interlock sequence or computation profile.
i. Begin or end point totalization.
j. Modify totalization values and limits.
k. Access or secure point.
l. Begin or end HVAC or load control system.
m. Modify load parameter.
n. Modify demand limiting and duty cycle targets.
6. Output summary: Listing of programmed function points, associated program times, and respective day of week programmed points by software groups or time of day.

D. Interlocking:
1. Permit events to occur, based on changing condition of one or more associated master points.
2. Binary contact, high/low limit of analog point or computed point shall be capable of being utilized as master. Same master may monitor or command multiple slaves.
3. Operator commands:
a. Define single master/multiple master interlock process.
b. Define logic interlock process.

c. Lock/unlock program.
d. Enable/disable interlock process.
e. Execute terminate interlock process.
f. Request interlock type summary.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.02 INSTALLATION

A. Install all Owner-provided equipment along with all contractor-provided equipment as required to provide a complete, fully functional building automation system.

B. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

C. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 23 09 93.

D. Provide with 120v AC, 15 amp dedicated emergency power circuit to each programmable control unit.

E. Provide conduit and electrical wiring in accordance with Section 26 27 17. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

F. Ensure that all components necessary to execute the sequences of operation are coordinated and installed by all contractors.

3.03 MANUFACTURER'S FIELD SERVICES

A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

B. Provide service engineer to instruct North Providence School Department's representative in operation of systems plant and equipment for 2 day period.

C. Provide basic operator training for 4 persons on data display, alarm and status descriptors, requesting data, execution of commands and request of logs. Include a minimum of 8 hours dedicated instructor time. Provide training on site.

3.04 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate complete and operating system to North Providence School Department.

3.05 SCHEDULES

A. Input/Output Schedule:
   1. Point Description:
   2. Digital Input:
      a. Demand Meter (kW):
      b. Auxiliary Contact:
      c. Switches:
         1) Switch Closing:
         2) Flow Switch:
         3) Optical:
      d. Current:
      e. Pressure:
   3. Digital Output:
      a. Control Relay:
      b. Solenoid:
      c. Contactor:

4. Analog Input:
    a. Temperature:
    b. Relative Humidity:
    c. Pressure/Vacuum:
    d. Filter:
    e. Flow:
    f. Current:
    g. Liquid Level:
    h. Photocell:
5. Analog Output:
    a. Pneumatic Transducer:
    b. 4-20 ma Module:
    c. 0-16 v DC:
6. Alarm:

B. Input/Output Schedule:
1. Point Description:
2. Inputs:
    a. Temperature:
    b. Relative Humidity:
    c. Pressure:
    d. Flow:
    e. Level:
    f. Position:
    g. Energy:
    h. Power:
3. Outputs:
    a. Status:
    b. Alarm:
    c. Pneumatic Position:
    d. Electronic Position:
    e. Set Point Adjust:
    f. Start/Stop:
    g. Off/Low/High:
4. Software Features:
    a. PID Control (DDC):
    b. High Limit:
    c. Low Limit:
    d. Run Time Totalization:
    e. Consumption Totalization:
    f. Program Start/Stop:
    g. Load Shed:
    h. Duty Cycle:
    i. Enthalpy Switchover:
    j. Optimal Run Time:
    k. Supply Air Reset:
    l. O.A. Interlock:
    m. O.A. Temperature Reset:
    n. Free Cooling Mode:
    o. Warm-up Mode:
    p. Boiler Interlock:
    q. Chiller Sequencing:
    r. Energy Calculation:

C. Alarm Schedule:

1. High Limit: A1.
2. Low Limit: A2.
3. Run Time: A3.
4. Maintenance: A4.
5. Status: A5.
6. Override: A6.
7. Freeze: A7.
8. Low Pressure: A8.

END OF SECTION 23 09 23

SECTION 23 09 93

SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

THE MECHANICAL CONTRACTOR SHALL PROVIDE ALL NECESSARY LABOR MATERIALS TO PROVIDE A FULLY FUNCTIONAL BUILDING AUTOMATION SYSTEM FOR THE PROJECT. THIS INCLUDES ALL CONTROL COMPONENTS, CONTROLLERS, WIRING, PROGRAMMING, AND COORDINATION BETWEEN TRADES TO ACCOMPLISH THE SEQUENCE OF OPERATIONS HEREIN. CONTRACTOR SHALL ENSURE THAT ALL COMPONENTS ARE COORDINATED BETWEEN EQUIPMENT SUPPLIERS AND CONTROLS VENDOR FOR ALL EQUIPMENT.

1.01 PART 1 GENERAL

1.02 SECTION INCLUDES

A. This section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other sections.

B. Sequence of operation for:
   1. Electric Radiation and Convectors
   2. Variable Refrigerant Volume (VRF/VRV) Systems
   3. Supply Air Units and Energy recovery

1.03 RELATED SECTIONS

A. Section 23 09 23 - Direct-Digital Control System for HVAC.

B. Section 23 09 13 - Instrumentation and Control Devices for HVAC.

C. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.04 SYSTEM DESCRIPTION

A. This Section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other Sections.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Sequence of Operation Documentation: Submit written sequence of operation for entire HVAC system and each piece of equipment.
   1. Preface: 1 or 2 paragraph overview narrative of the system describing its purpose, components and function.
   2. State each sequence in small segments and give each segment a unique number for referencing in Functional Test procedures; provide a complete description regardless of the completeness and clarity of the sequences specified in the contract documents.
   3. Include at least the following sequences:
      a. Start-up.
      b. Warm-up mode.
      c. Normal operating mode.
      d. Unoccupied mode.
      e. Shutdown.
      f. Capacity control sequences and equipment staging.
      g. Temperature and pressure control, such as setbacks, setups, resets, etc.
      h. Detailed sequences for all control strategies, such as economizer control, optimum start/stop, staging, optimization, demand limiting, etc.
      i. Effects of power or equipment failure with all standby component functions.
      j. Sequences for all alarms and emergency shut downs.
      k. Seasonal operational differences and recommendations.
      l. Interactions and interlocks with other systems.
   4. Include initial and recommended values for all adjustable settings, setpoints and parameters that are typically set or adjusted by operating staff; and any other control

settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.

5. For packaged controlled equipment, include manufacturer's furnished sequence of operation amplified as required to describe the relationship between the packaged controls and the control system, indicating which points are adjustable control points and which points are only monitored.
6. Include schedules, if known.

C. Control System Diagrams: Submit graphic schematic of the control system showing each control component and each component controlled, monitored, or enabled.
   1. Label with settings, adjustable range of control and limits.
   2. Include flow diagrams for each control system, graphically depicting control logic.
   3. Include the system and component layout of all equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
   4. Include draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.
   5. Include all monitoring, control and virtual points specified in elsewhere.
   6. Include a key to all abbreviations.

D. Points List: Submit list of all control points indicating at least the following for each point.
   1. Name of controlled system.
   2. Point abbreviation.
   3. Point description; such as dry bulb temperature, airflow, etc.
   4. Display unit.
   5. Control point or setpoint (Yes / No); i.e. a point that controls equipment and can have its setpoint changed.
   6. Monitoring point (Yes / No); i.e. a point that does not control or contribute to the control of equipment but is used for operation, maintenance, or performance verification.
   7. Intermediate point (Yes / No); i.e. a point whose value is used to make a calculation which then controls equipment, such as space temperatures that are averaged to a virtual point to control reset.
   8. Calculated point (Yes / No); i.e. a “virtual” point generated from calculations of other point values.

E. Project Record Documents: Record actual locations of components and setpoints of controls, including changes to sequences made after submission of shop drawings.

1.06 QUALITY ASSURANCE

A. Design system under direct supervision of a Professional Engineer experienced in design of this Work and licensed in Rhode Island.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL SYSTEM DESIGN AND OPERATION STANDARDS

A. The BAS shall control the mechanical systems within the site based upon the following design parameters:
   1. Classrooms, offices, corridors, etc shall be heated and cooled by a VRV heat-pump array, with outdoor-air delivered via a dedicated energy-recovery ventilation unit. All units shall be controlled by the BAS. The units shall be controlled by a new DDC controller and DDC-based temperature sensors with local control adjustment of +/- 2 degrees F (adjustable). This shall interface with the factory controller to provide full adjustment as indicated in the sequence below but shall not take the place of the factory controls and safeties governing the refrigeration systems.

B. Each unit shall be controlled by an individual DDC Controller and all required sensors, control valves, and appurtenances required to complete the sequence of operation. Units shall include

occupied/unoccupied control, night-setback, morning warm-up/cool-down, and enthalpy-based economizer functions.

3.02 ELECTRIC RADIATION AND CONVECTORS

A. The electric radiation or convector units controlled by independent temperature sensors mounted within the space being served. The unit shall be energized and de-energized to maintain temperature within the space (70 ºF, user adjustable).

B. When the HVAC system is in cooling mode, the unit shall be de-energized.

C. The following items shall be displayed at the Operator's Terminal:
   1. Temperature Setpoint.
   2. Actual space temperature.
   3. Commanded status of unit (on/off).

3.03 VARIABLE REFRIGERANT VOLUME HEAT PUMP SYSTEMS

A. The variable refrigerant split system shall have a BAS DDC interface wired to the manufacturer factory central system controller to provide operation, configuration, and monitoring of the system. The manufacturer factory central controller shall operate in BACnet protocol, and be connected to manufacturer factory space temperature sensors as specified.

B. Sequence of operation:
   1. Cooling Mode: Cooling mode shall be selected based on outdoor air temperatures or manually enabled or scheduled from the workstation. During the programmed occupied mode, the supply fan shall run continuously. On a rise in space temperature above the setpoint (75 degrees, adjustable), the manufacturer central controller shall energize the central compressor to provide cooling. The internal capacity control valve in the evaporator unit shall modulate to control the flow of refrigerant to maintain space temperature. On a fall in space temperature the refrigerant capacity control valve shall modulate closed.
   2. Heating Mode: Heating mode shall be selected based on outdoor air temperatures or manually enabled or scheduled from the workstation. During the programmed occupied mode, the supply fan shall run continuously. On a drop in space temperature below the setpoint (68 degrees, adjustable), the manufacturer central controller shall energize the central compressor to with the requisite reversing valve to provide heating to the evaporator unit as required. The internal capacity control valve in the evaporator unit shall modulate to control the flow of refrigerant to maintain space temperature. On a fall in space temperature the refrigerant capacity control valve shall modulate closed.
   3. The following items shall be accessible and displayed at the Operator's Terminal:
      a. Space temperature setpoint at each fan-coil unit (user adjustable).
      b. Actual space temperature of each fan-coil unit space.
      c. Operational status of each fan-coil unit (heating, cooling, off, user adjustable).
      d. Factory error codes from each unit.
      e. Remote space temperature sensor override for each fan-coil unit (user adjustable to limit temperature adjustment range, heat/cool selection, fan speed).
      f. Compressor Status

C. Each terminal unit (fan coil) shall be controlled by the factory-provided wall-mounted controller. The controller shall be capable of allowing space temperature adjustment of +1 / -1 degrees (user adjustable).

D. For all public corridors, restrooms, and vestibules, provide stainless-steel flat-plate type temeprature sensors with no setpoint adjustment.

3.04 ENERGY RECOVERY VENTILATORS (ERV) FOR VRF SYSTEMS

A. Supply air units and ERV's shall be scheduled for occupied and unoccupied cycles based on an operator adjustable time schedule. Units may also be manually enabled and disabled at the operator workstation. Fan status shall be monitored by the BAS via the fans current sensing relay.

B. The variable frequency drives shall be set by the balancer to deliver the minimum outdoor air to each associated terminal unit under fully-occupied conditions.

C. When any heat pump in the area served be the heat recovery unit is in the occupied mode the unit shall be energized.
   1. The unit exhaust and outside air isolation dampers shall open.
   2. Provide proof of airflow for each fan and provide fan failure alarms.
   3. Provide temperature indication of the supply and exhaust inlet and leaving air.
   4. For units over 2,000 cfm a duct smoke detector shall be provided by the electrical contractor. Provide the interlock wiring to shut down the units upon activation.
   5. The electric heating coil shall be energized when required to maintain a minimum discharge air (supply air) temperature of 70 degrees to the units.

D. The following items shall be displayed at the operators workstation:
   1. Discharge temperature.
   2. Return air temperature.
   3. Outside air temperature, humidity and enthalpy.
   4. Fan operational status via current sensor.
   5. Commanded status of fan.
   6. Commanded status of heating coils (as applicable).
   7. Commanded position of dampers.
   8. Diagram showing the layout of the unit with major components and dynamic temperatures shown where temperature sensors exist in the system.

END OF SECTION 23 09 93

SECTION 23 23 00
REFRIGERANT PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping.
B. Refrigerant.
C. Moisture and liquid indicators.
D. Valves.
E. Strainers.
F. Check valves.
G. Pressure relief valves.
H. Filter-driers.
I. Solenoid valves.
J. Expansion valves.
K. Receivers.
L. Flexible connections.

1.02 RELATED REQUIREMENTS

A. Section 08 31 00 - Access Doors and Panels.
B. Section 09 90 00 - Painting and Coating.
C. Section 23 07 19 - HVAC Piping Insulation.
D. Section 23 81 29 - Variable Refrigerant Volume (VRV, VRF) HVAC System
E. Section 23 09 93 - Sequence of Operations for HVAC Controls.
F. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AHRI 495 - Performance Rating of Refrigerant Liquid Receivers.
B. AHRI 710 - Performance Rating of Liquid-Line Driers.
C. AHRI 730 (I-P) - Flow Capacity Rating of Suction-Line Filters and Suction-Line Filter-Driers.
D. AHRI 750 - Thermostatic Refrigerant Expansion Valves.
E. AHRI 760 - Performance Rating of Solenoid Valves for Use With Volatile Refrigerants.
F. ASHRAE Std 15 - Safety Standard for Refrigeration Systems and Designation and Classification of Refrigerants .
G. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants.
H. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels.
I. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fuzing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications.
J. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
K. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
L. ASME B31.5 - Refrigeration Piping and Heat Transfer Components.
M. ASME B31.9 - Building Services Piping.
N. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

O. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

P. ASTM B88 - Standard Specification for Seamless Copper Water Tube.

Q. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric).

R. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

S. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

T. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

U. AWS D1.1/D1.1M - Structural Welding Code - Steel.

V. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

W. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc..

X. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc..

Y. UL 429 - Electrically Operated Valves.

1.04 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Provide pipe hangers and supports in accordance with MSS SP-69 unless indicated otherwise.

C. Liquid Indicators:
   1. Use line size liquid indicators in main liquid line leaving condenser.
   2. If receiver is provided, install in liquid line leaving receiver.
   3. Use line size on leaving side of liquid solenoid valves.

D. Valves:
   1. Use service valves on suction and discharge of compressors.
   2. Use gage taps at compressor inlet and outlet.
   3. Use gage taps at hot gas bypass regulators, inlet and outlet.
   4. Use check valves on compressor discharge.
   5. Use check valves on condenser liquid lines on multiple condenser systems.

E. Refrigerant Charging (Packed Angle) Valve: Use in liquid line between receiver shut-off valve and expansion valve.

F. Strainers:
   1. Use line size strainer upstream of each automatic valve.
   2. Where multiple expansion valves with integral strainers are used, use single main liquid line strainer.
   3. On steel piping systems, use strainer in suction line.
   4. Use shut-off valve on each side of strainer.

G. Pressure Relief Valves: Use on ASME receivers and pipe to outdoors.

H. Filter-Driers:
   1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.
   2. Use a filter-drier on suction line just ahead of compressor.
   3. Use sealed filter-driers in lines smaller than 1/2 inch outside diameter.
   4. Use sealed filter-driers in low temperature systems.
   5. Use sealed filter-driers in systems utilizing hermetic compressors.

6. Use replaceable core filter-driers in lines of 1/2 inch outside diameter or greater.
7. Use replaceable core liquid-line filter-driers in systems utilizing receivers.
8. Use filter-driers for each solenoid valve.

I. Solenoid Valves:
1. Use in liquid line of systems operating with single pump-out or pump-down compressor control.
2. Use in liquid line of single or multiple evaporator systems.
3. Use in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into the suction line when system shuts down.

J. Receivers:
1. Use on systems five tons and larger, sized to accommodate pump down charge.
2. Use on systems with long piping runs.

K. Flexible Connectors: Utilize at or near compressors where piping configuration does not absorb vibration.

1.05 SUBMITTALS

A. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

B. Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, and sizes.

C. Design Data: Submit design data indicating pipe sizing. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

D. Test Reports: Indicate results of leak test, acid test.

E. Manufacturer's Installation Instructions: Indicate support, connection requirements, and isolation for servicing.

F. Submit welders certification of compliance with ASME (BPV IX) or AWS D1.1.

G. Project Record Documents: Record exact locations of equipment and refrigeration accessories on record drawings.

H. Maintenance Data: Include instructions for changing cartridges, assembly views, spare parts lists.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum five years of documented experience.

B. Design piping system under direct supervision of a Professional Engineer experienced in design of this type of work.

C. Design piping system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in Rhode Island.

1.07 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 for installation of piping system.

B. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.

C. Welders Certification: In accordance with ASME (BPV IX) or AWS D1.1.

D. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

1.09 MAINTENANCE PRODUCTS

A. See Section 01 60 00 - Product Requirements, for additional provisions.

B. Provide two refrigeration oil test kits each containing everything required to conduct one test.

C. Provide two filter-dryer cartridges of each type.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Filter-Driers:
   1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

2.02 REGULATORY REQUIREMENTS

2.03 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn .
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy.

B. Copper Tube to 7/8 inch OD: ASTM B88 (ASTM B88M), Type K (A), annealed.
   1. Fittings: ASME B16.26 cast copper.
   2. Joints: Flared.

C. Pipe Supports and Anchors:
   1. Conform to ASTM F 708, MSS SP-58, MSS SP-69, and MSS SP-89.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Carbon steel adjustable swivel, split ring.
   3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
   6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
   7. Vertical Support: Steel riser clamp.
   8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
   10. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
   11. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.04 REFRIGERANT

A. Refrigerant: R-410A

2.05 MOISTURE AND LIQUID INDICATORS

A. Manufacturers:
   1. Henry Technologies: www.henrytech.com/#sle.
   2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
   3. Sporlan Valve Company: www.sporlan.com/#sle.

B. Indicators: Single or Doubleport type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.06 VALVES

A. Manufacturers:

1. Hansen Technologies Corporation: www.hantech.com/#sle.
2. Henry Technologies: www.henrytech.com/#sle.
3. Danfoss Flomatic: www.flomatic.com/#sle.

B. Diaphragm Packless Valves:
1. UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, solder or flared ends, with positive backseating; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.

C. Packed Angle Valves:
1. Forged brass or nickel plated forged steel, forged brass seal caps with copper gasket, rising stem and seat with backseating, molded stem packing, solder or flared ends; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.

D. Ball Valves:
1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F.

E. Service Valves:
1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi.

2.07 STRAINERS

A. Straight Line or Angle Line Type:
1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

B. Straight Line, Non-Cleanable Type:
1. Steel shell, copper plated fittings, stainless steel wire screen, for maximum working pressure of 500 psi.

2.08 CHECK VALVES

A. Manufacturers:
1. Hansen Technologies Corporation: www.hantech.com/#sle.
2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
3. Sporlan Valve Company: www.sporlan.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Globe Type:
1. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc; for maximum temperature of 300 degrees F and maximum working pressure of 500 psi.

C. Straight Through Type:
1. Brass body and disc, phosphor-bronze or stainless steel spring, neoprene seat; for maximum working pressure of 500 psi and maximum temperature of 200 degrees F.

2.09 PRESSURE REGULATORS

A. Manufacturers:
1. Hansen Technologies Corporation: www.hantech.com/#sle.
2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
3. Sporlan Valve Company: www.sporlan.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Brass body, stainless steel diaphragm, direct acting, adjustable over 0 to 80 psi range, for maximum working pressure of 450 psi.

2.10 PRESSURE RELIEF VALVES

A. Manufacturers:

1. Hansen Technologies Corporation: www.hantech.com/#sle.
2. Henry Technologies: www.henrytech.com/#sle.
3. Sherwood Valve/Harsco Corporation: www.sherwoodvalve.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Straight Through or Angle Type: Brass body and disc, neoprene seat, factory sealed and stamped with ASME UV and National Board Certification NB, selected to ASHRAE Std 15, with standard setting of 425 psi, adjusted to meet system requirements.

2.11 FILTER-DRIERS

A. Manufacturers:
1. Flow Controls Division of Emerson Electric: www.emersonflowcontrols.com/#sle.
2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
3. Sporlan Valve Company: www.sporlan.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Performance:
1. Flow Capacity - Liquid Line: As indicated in schedule, minimum, rated in accordance with AHRI 710.
2. Flow Capacity - Suction Line: As indicated in schedule, minimum, rated in accordance with AHRI 730 (I-P).
3. Water Capacity: As indicated in schedule, rated in accordance with AHRI 710.
4. Pressure Drop: 2 psi, As indicated in schedule, maximum, when operating at full connected evaporator capacity.
5. Design Working Pressure: As indicated in schedule or 350 psi, minimum.

C. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns; of construction that will not pass into refrigerant lines.

D. Construction: UL listed.
1. Replaceable Core Type: Steel shell with removable cap.
2. Sealed Type: Copper shell.
3. Connections: As specified for applicable pipe type.

2.12 SOLENOID VALVES

A. Manufacturers:
1. Flow Controls Division of Emerson Electric: www.emersonflowcontrols.com/#sle.
2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
3. Sporlan Valve Company: www.sporlan.com/#sle.

B. Valve: AHRI 760, pilot operated, copper or brass body and internal parts, synthetic seat, stainless steel stem and plunger assembly (permitting manual operation in case of coil failure), integral strainer, with flared, solder, or threaded ends; for maximum working pressure of 500 psi.

C. Coil Assembly: UL 429, UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, with surge protector and color coded lead wires, integral junction box with pilot light.

D. Electrical Characteristics: per drawings.

2.13 EXPANSION VALVES

A. Manufacturers:
1. Flow Controls Division of Emerson Electric: www.emersonflowcontrols.com/#sle.
2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
3. Sporlan Valve Company: www.sporlan.com/#sle.

B. Angle or Straight Through Type: AHRI 750; design suitable for refrigerant, brass body, internal or external equalizer, mechanical pressure limit (maximum operating pressure MOP feature),

adjustable superheat setting, replaceable inlet strainer, with replaceable capillary tube and remote sensing bulb and remote bulb well.

C. Selection: Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. Select valve for maximum load at design operating pressure and minimum 10 degrees F superheat. Select to avoid being undersized at full load and excessively oversized at part load.

2.14 ELECTRONIC EXPANSION VALVES

A. Manufacturers:
   1. Danfoss Automatic Controls: www.danfoss.com.
   2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
   3. Sporlan Valve Company: www.sporlan.com/#sle.

B. Valve:
   1. Brass body with flared or solder connection, needle valve with floating needle and machined seat, stepper motor drive.
   2. Capacity: per drawings.
   3. Electrical Characteristics: per drawings.

C. Evaporation Control System:
   1. Electronic microprocessor based unit in enclosed case, proportional integral control with adaptive superheat, maximum operating pressure function, preselection allowance for electrical defrost and hot gas bypass.
   2. Electrical Characteristics: per drawings.

D. Refrigeration System Control: Electronic microprocessor based unit in enclosed case, with proportional integral control of valve, on/off thermostat, air temperature alarm (high and low), solenoid valve control, liquid injection adaptive superheat control, maximum operating pressure function, night setback thermostat, timer for defrost control.

2.15 RECEIVERS

A. Manufacturers:
   1. Henry Technologies: www.henrytech.com/#sle.
   2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
   3. Sherwood Valve/Harsco Corporation: www.sherwoodvalve.com/#sle.

B. Internal Diameter 6 inch and Smaller:
   1. AHRI 495, UL listed, steel, brazed; 400 psi maximum pressure rating, with tappings for inlet, outlet, and pressure relief valve.

C. Internal Diameter Over 6 inch:
   1. AHRI 495, welded steel, tested and stamped in accordance with ASME (BPV VIII, 1); 400 psi with tappings for liquid inlet and outlet valves, pressure relief valve, and magnetic liquid level indicator.

2.16 FLEXIBLE CONNECTORS

A. Manufacturers:
   1. Circuit Hydraulics, Ltd: www.circuit-hydraulics.co.uk.
   2. Flexicraft Industries: www.flexicraft.com/#sle.
   3. Penflex: www.penflex.com/#sle.

B. Corrugated stainless steel or bronze hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure of 500 psi.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of or recessed into and grouted flush with slab.

G. Pipe Hangers and Supports:
   1. Install in accordance with ASTM F 708 and MSS SP-89.
   2. Support horizontal piping as scheduled.
   3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow.
   5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
   6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   7. Provide copper plated hangers and supports for copper piping.

H. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

I. Provide clearance for installation of insulation and access to valves and fittings.

J. Provide access to concealed valves and fittings. Coordinate size and location of access doors with Section 08 31 00.

K. Flood piping system with nitrogen when brazing.

L. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.

M. Prepare unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 90 00.

N. Insulate piping and equipment; refer to Section and Section 22 07 16.

O. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

P. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.

Q. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

R. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

S. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

T. Fully charge completed system with refrigerant after testing.

U. Provide electrical connection to solenoid valves. Refer to Section 26 27 17.

3.03 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ASME B31.5.

B. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using electronic leak detector. Test to no leakage.

3.04 SCHEDULES

A. Hanger Spacing for Copper Tubing.
   1. 1/2 inch, 5/8 inch, and 7/8 inch OD: Maximum span, 5 feet; minimum rod size, 3/8 inch.
   2. 1-1/8 inch OD: Maximum span, 6 feet; minimum rod size, 3/8 inch.
   3. 1-3/8 inch OD: Maximum span, 7 feet; minimum rod size, 3/8 inch.
   4. 1-5/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   5. 2-1/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   6. 2-5/8 inch OD: Maximum span, 9 feet; minimum rod size, 3/8 inch.
   7. 3-1/8 inch OD: Maximum span, 10 feet; minimum rod size, 3/8 inch.
   8. 3-5/8 inch OD: Maximum span, 11 feet; minimum rod size, 1/2 inch.
   9. 4-1/8 inch OD: Maximum span, 12 feet; minimum rod size, 1/2 inch.

B. Hanger Spacing for Steel Piping.
   1. 1/2 inch, 3/4 inch, and 1 inch: Maximum span, 7 feet; minimum rod size, 3/8 inch.
   2. 1-1/4 inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   3. 1-1/2 inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
   4. 2 inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
   5. 2-1/2 inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
   6. 3 inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
   7. 4 inches: Maximum span, 12 feet; minimum rod size, 1/2 inch.

END OF SECTION 23 23 00

SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.

1.02 RELATED REQUIREMENTS

A. Section 23 07 13 - Duct Insulation.

B. Section 23 33 00 - Air Duct Accessories.

C. Section 23 36 00 - Air Terminal Units.

D. Section 23 37 00 - Air Outlets and Inlets.

E. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

D. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.

E. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

F. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

G. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

H. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.

I. ASTM C14M - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, Culvert Pipe (Metric).

J. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

K. ASTM C443M - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric).

L. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

M. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

N. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

O. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; Sheet Metal and Air Conditioning Contractors' National Association.

P. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible.

Q. SMACNA (FGD) - Fibrous Glass Duct Construction Standards.

R. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors.

S. IECC 2012 - International Energy Conservation Code - Duct construciton standards, leakage testing

1.04 PERFORMANCE REQUIREMENTS

A. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for duct materials and duct connections.

C. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for all systems.

D. MANDATORY Test Reports: Pressure test all ductwork. Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual.
   1. Utilize standard equation CL=FP^0.65 where F= Measured leakage rate in CFM per 100 square feet of duct surface, and P = Static Pressure of the test. Leakage rate shall not exceed 4.0 in that equation.

E. Manufacturer's Certificate: Certify that installation of glass fiber ductwork meet or exceed recommended fabrication and installation requirements.

F. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum five years of documented experience.

1.07 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A, NFPA 90B, and NFPA 96 standards.

1.08 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 DUCT ASSEMBLIES

2.02 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.

B. Aluminum for Ducts: ASTM B209 (ASTM B209M); aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T651 or of equivalent strength.

C. Stainless Steel for Ducts: ASTM A 240/A 240M, Type 304.

D. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

E. Insulated Flexible Ducts:
   1. Two ply vinyl film supported by helically wound spring steel wire; fiberglass insulation; polyethylene vapor barrier film.
      a. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.
      b. Maximum Velocity: 4000 fpm.
      c. Temperature Range: -10 degrees F to 160 degrees F.

F. Stainless Steel Ducts: ASTM A 666, Type 304.

G. All Ducts: Galvanized steel, unless otherwise indicated.

H. Low Pressure Supply (Heating Systems): 1 inch w.g. pressure class, galvanized steel.

I. Low Pressure Supply (System with Cooling Coils): 1 inch w.g. pressure class, galvanized steel.

J. Medium and High Pressure Supply (All VAV Primary Supply Duct between AHU and VAV Terminal Unit): 2 inch w.g. pressure class, galvanized steel.

K. Return and Relief: 1 inch w.g. pressure class, galvanized steel.

L. General Exhaust: 1 inch w.g. pressure class, galvanized steel.

M. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
   2. VOC Content: Not more than 250 g/L, excluding water.

2.03 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards and as indicated.

B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide turning vanes. .

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA HVAC Duct Construction Standards.

F. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

G. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

H. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.04 MANUFACTURED DUCTWORK AND FITTINGS

A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages,reinforcing, and sealing for operating pressures indicated.

B. Double Wall Insulated Round Ducts: Round spiral lockseam duct with paintable galvanized steel outer wall, perforated galvanized steel inner wall; fitting with solid inner wall. Provide paint in color selected by architect.
   1. Manufacture in accordance with SMACNA HVAC Duct Construction Standards.
   2. Insulation:
      a. Thickness: 2 inch.
      b. Material: Fiberglass, with mylar coating between insulation and perforated liner.

C. Double Wall Insulated Rectangular Ducts: Rectangular spiral lockseam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with solid inner wall.
   1. Manufacture in accordance with SMACNA (DCS).
   2. Insulation:
      a. Thickness: 2 inch.
      b. Material: Fiberglass, with mylar coating between insulation and perforated liner.

D. Transverse Duct Connection System: SMACNA "J" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.
   1. Manufacturers:

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA HVAC Duct Construction Standards.

B. Install in accordance with manufacturer's instructions.

C. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

D. Install and seal metal and flexible ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

E. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

F. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

G. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.

H. Use double nuts and lock washers on threaded rod supports.

I. Tape joints of PVC coated metal ductwork with PVC tape.

J. Connect terminal units to supply ducts with one foot maximum length of flexible duct. Do not use flexible duct to change direction.

K. Connect diffusers or light troffer boots to low pressure ducts with 5 feet maximum length of flexible duct held in place with strap or clamp.

L. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

M. Set plenum doors 6 to 12 inches above floor. Arrange door swings so that fan static pressure holds door in closed position.

N. Use stainless steel for ductwork exposed to view and stainless steel or carbon steel for ducts where concealed.

O. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

P. At exterior wall louvers, seal duct to louver frame and install blank-out panels as required.

3.02 CLEANING AND TESTING

A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment that could be harmed by excessive dirt with temporary filters, or bypass during cleaning.

B. Conduct required duct-leakage testing as defined within this specification and otherwise noted in the contract documents.

3.03 SCHEDULES

A. Ductwork Material:
   1. Low Pressure Supply (Heating Systems): Steel, Aluminum.
   2. Low Pressure Supply (System with Cooling Coils): Steel, Aluminum.
   3. Medium and High Pressure Supply: Steel.
   4. Return and Relief: Steel, Aluminum.
   5. General Exhaust: Steel, Aluminum.
   6. Outside Air Intake: Steel.

7. Exposed round ductwork: Double-walled spiral.

B. Ductwork Pressure Class:
   1. Supply (Heating Systems): 1 inch
   2. Supply (System with Cooling Coils): 2 inch.
   3. Return and Relief: 1 inch.
   4. General Exhaust: 1 inch.
   5. Outside Air Intake: 1 inch.

END OF SECTION 23 31 00

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air turning devices/extractors.
B. Combination fire and smoke dampers.
C. Duct access doors.
D. Duct test holes.
E. Fire dampers.
F. Flexible duct connections.
G. Smoke dampers.
H. Volume control dampers.

1.02 RELATED REQUIREMENTS

A. Section 23 31 00 - HVAC Ducts and Casings.
B. Section 23 36 00 - Air Terminal Units: Pressure regulating damper assemblies.
C. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.
B. NFPA 92 - Standard for Smoke Control Systems.
C. NFPA 92A - Standard for Smoke-Control Systems Utilizing Barriers and Pressure Differences.
D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible.
E. UL 33 - Safety Heat Responsive Links for Fire-Protection Service.
F. UL 555 - Standard for Fire Dampers.
G. UL 555S - Standard for Smoke Dampers.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.
C. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers, duct access doors, and duct test holes.
D. Manufacturer's Installation Instructions: Provide instructions for fire dampers and combination fire and smoke dampers.

1.05 PROJECT RECORD DOCUMENTS

A. Record actual locations of access doors and test holes.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum five years of documented experience.
B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

1.08 EXTRA MATERIALS

A. See Section 01 60 00 - Product Requirements, for additional provisions.

B. Provide two of each size and type of fusible link.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

A. Manufacturers:
   1. Krueger: www.krueger-hvac.com/#sle.
   2. Ruskin Company: www.ruskin.com/#sle.
   3. Titus: www.titus-hvac.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.02 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:
   1. Louvers & Dampers, Inc: www.louvers-dampers.com/#sle.
   2. Nailor Industries Inc: www.nailor.com/#sle.
   3. Ruskin Company: www.ruskin.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.

C. Provide factory sleeve and collar for each damper.

D. Multiple Blade Dampers: Fabricate with 16 gage galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.

E. Operators: UL listed and labelled spring return electric type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on interior of duct and link to damper operating shaft.

F. Normally Closed Smoke Responsive Fire Dampers: Curtain type, opening by gravity upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure.

G. Normally Open Smoke Responsive Fire Dampers: Curtain type, closing upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure, stainless steel springs with locking devices to ensure positive closure for units mounted horizontally.

H. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.

2.03 DUCT ACCESS DOORS

A. Manufacturers:
   1. Nailor Industries Inc: www.nailor.com/#sle.
   2. Ruskin Company: www.ruskin.com/#sle.
   3. SEMCO Incorporated: www.semcoinc.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards and as indicated.

C. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.
   1. Less Than 12 inches Square: Secure with sash locks.
   2. Up to 18 inches Square: Provide two hinges and two sash locks.

3. Up to 24 x 48 inches: Three hinges and two compression latches with outside and inside handles.
4. Larger Sizes: Provide an additional hinge.

D. Access doors with sheet metal screw fasteners are not acceptable.

2.04 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.05 FIRE DAMPERS

A. Manufacturers:
1. Louvers & Dampers, Inc: www.louvers-dampers.com/#sle.
2. Nailor Industries Inc: www.nailor.com/#sle.
3. Ruskin Company: www.ruskin.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

C. Ceiling Dampers: Galvanized steel, 22 gage frame and 16 gage flap, two layers 0.125 inch ceramic fiber on top side and one layer on bottom side for round flaps, with locking clip.

D. Horizontal Dampers: Galvanized steel, 22 gage frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.

E. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations or closure under air flow conditions. Configure with blades out of air stream except for 1.0 inch pressure class ducts up to 12 inches in height.

F. Multiple Blade Dampers: 16 gage galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

G. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

2.06 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.
1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
a. Net Fabric Width: Approximately 6 inches wide.
2. Metal: 3 inches wide, 24 gage thick galvanized steel.

C. Leaded Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lbs per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.

2.07 SMOKE DAMPERS

A. Manufacturers:
1. Louvers & Dampers, Inc: www.louvers-dampers.com/#sle.
2. Nailor Industries Inc: www.nailor.com/#sle.
3. Ruskin Company: www.ruskin.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fabricate in accordance with NFPA 90A and UL 555S, and as indicated.

C. Dampers: UL Class 1 multiple blade type fire damper, normally closed automatically operated by electric actuator.

D. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.

2.08 VOLUME CONTROL DAMPERS

A. Manufacturers:
   1. Louvers & Dampers, Inc: www.louvers-dampers.com/#sle.
   2. Nailor Industries Inc: www.nailor.com/#sle.
   3. Ruskin Company: www.ruskin.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards and as indicated.

C. Splitter Dampers:
   1. Material: Same gage as duct to 24 inches size in either direction, and two gages heavier for sizes over 24 inches.
   2. Blade: Fabricate of double thickness sheet metal to streamline shape, secured with continuous hinge or rod.
   3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw .

D. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.

E. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

F. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

G. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards. Refer to Section 23 31 00 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

F. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.
   1. Smoke dampers shall be integrated into the "smoke purge control system". Dampers in the return ductwork shall be overridden to the open position when the smoke purge is activated.

G. Demonstrate re-setting of fire dampers to North Providence School Department's representative.

H. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

I. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment; see Section 22 05 48.

J. For fans developing static pressures of 5.0 inches and over, cover flexible connections with leaded vinyl sheet, held in place with metal straps.

K. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

L. Use splitter dampers only where indicated.

M. Provide balancing dampers on high velocity systems where indicated. Refer to Section 23 36 00 - Air Terminal Units.

N. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION 23 33 00

SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Diffusers.
   1. Rectangular Ceiling Diffusers
   2. Perforated Face Ceiling Return Diffusers

1.02 RELATED REQUIREMENTS

A. Section 09 90 00 - Painting and Coating: Painting of ducts visible behind outlets and inlets.

1.03 REFERENCE STANDARDS

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating.

B. ARI 890 - Standard for Air Diffusers and Air Diffuser Assemblies; Air-Conditioning and Refrigeration Institute.

C. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets.

D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

C. Samples: Submit one of each required air outlet and inlet type.

D. Project Record Documents: Record actual locations of air outlets and inlets.

1.05 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

B. Test and rate louver performance in accordance with AMCA 500-L.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum five years of documented experience.

1.07 MOCK-UP

A. Provide mock-up of typical exterior or exterior ceiling module with supply and return air outlets.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carnes Company HVAC: www.carnes.com.

B. Krueger: www.krueger-hvac.com/#sle.

C. Price Industries: www.price-hvac.com/#sle.

D. Titus: www.titus-hvac.com/#sle.

E. Tuttle and Bailey: www.tuttleandbailey.com.

F. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 RECTANGULAR CEILING DIFFUSERS

A. Type: Square, stamped, multi-core diffuser to discharge air in 360 degree pattern as shown on drawings and with sectorizing baffles where indicated.

B. Frame: Surface mount or inverted T-bar as indicated on drawings. In plaster ceilings, provide plaster frame and ceiling frame.

C. Fabrication: Aluminum with baked enamel off-white finish.

D. Accessories: Radial opposed blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.

2.03 PERFORATED FACE CEILING RETURN DIFFUSERS

A. Type: Perforated face with removable face. Provide with filter rack where indicated on drawings.

B. Frame: Surface mount or Inverted T-bar as indicated on drawings. In plaster ceilings, provide plaster frame and ceiling frame.

C. Fabrication: Steel with steel or aluminum frame and baked enamel off-white finish.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

E. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 90 00.

3.02 AIR OUTLET AND INLET SCHEDULE

A. See Drawings

END OF SECTION 23 37 00

SECTION 23 72 23

PACKAGED AIR-TO-AIR ENERGY RECOVERY UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Packaged dessicant air-to-air energy recovery units.

1.02 RELATED SECTIONS

A. Section 23 08 00 - Commissioning of HVAC Systems

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Energy Recovery Ventilators:
   1. Renew Aire: www.renewaire.com.
   2. Nu-Air: www.nu-air.com
   3. Innovent: www.innoventair.com
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ENERGY RECOVERY UNITS

A. Energy Recovery Units: Fixed membrane cross-flow energy exchange type (hydroscopic resin) type; prefabricated packaged system designed by manufacturer.
   1. Access: Hinged access panels on front. Pressure taps provided.
   2. Lifting holes at the unit base.
   3. Permanent name plate listing manufacturer, model number, serial number, and voltage mounted inside door near electrical panel.

2.03 CASING

A. Wall, Floor, and Roof Panels:
   1. Construction: 1 inch thick, double wall box construction, with formed edges of exterior wall overlapping formed edges of interior wall.
   2. Exterior Wall: galvanized steel sheet. or aluminum.
      a. 20 gage galvanized steel,
      b. Color: Gray or white
   3. Interior Wall: Galvanized sheet metal.
      a. 22 gage, 0.0299 inch galvanized sheet metal.
   4. Insulation:
      a. 1 inch insulated fiberglass board insulation.
      b. Flame Spread Index: 25, maximum, when tested in accordance with ASTM E84, NFPA 255, and UL 723.
      c. Smoke Developed Index: 50, maximum, when tested in accordance with ASTM E84, NFPA 255, and UL 723.
   5. Roof Panel: Weatherproof.
   6. Panel Joints: 20 gauge steel with lapped corners and zinc-plated screws.
   7. Fasteners: Stainless steel.
   8. Isolation and Seal: Form continuous, thermally isolated, weather tight seal between inner wall of panels and structural framing with closed cell PVC foam gasketing.
   9. Seams: Sealed, requiring no caulking at job site.
   10. Coating: Polyurethane enamel.

B. Access Panels: Provide access to components through a large, tightly sealed and easily removable panel.

C. Doors:
   1. Construct doors of same construction and thickness as wall panels.
   2. Hardware:
      a. Corrosion-resistant.

2.04 FANS

A. Provide separate fans for exhaust and supply blowers.

B. Fans:
   1. Individually driven with a dedicated motor.

C. Bearings:
   1. Pillow block.
   2. Bearings: Permanently lubricated sealed ball bearings.
   3. Rated for not less than 200,000 hours of operation with accessible greased fittings.

D. Housings: 12 gage, 0.1046 inch aluminized steel with plenums integral to general housing and constructed to Class 1 fan standards.

E. Motors:
   1. Motors: Open drip proof or ECM direct drive or VFD-driven as scheduled.
   2. Efficiency: Premium.
   3. Speed: Variable.
   4. Control: Variable Frequency Drive.
   5. Fan Motor: Thermal overload protected.
   6. Fan Motor: UL listed and labeled.

F. Drives:
   1. Fans: Belt driven or direct as scheduled.
   2. Sheaves: Variable.
   3. Service Factor: 1.2.

2.05 TOTAL ENERGY RECOVERY MEDIA

A. Transfer heat and humidity from one air stream to the other with no carryover of the exhaust air into the supply air stream.

B. Effectiveness: Rated in accordance with ASHRAE Std 84 and AHRI 1060.

C. Flame Spread Index: 25, maximum, when tested in accordance with ASTM E84, NFPA 255, and UL 723.

D. Smoke Developed Index: 50, maximum, when tested in accordance with ASTM E84, NFPA 255, and UL 723.

E. Energy Recovery Media Facing:
   1. Conform to NFPA 90A.

F. Coat all corrugated surfaces with a thin non-migrating absorbent layer.

2.06 FILTERS

A. Efficiency: 13 MERV.

B. Fresh Air Stream: MERV 13 filters constructed to meet ASHRAE Std 52.2.

C. Exhaust Air Stream: MERV 8 filters constructed to meet ASHRAE Std 52.2.

D. Mount 1/2 inches thick permanent aluminum washable type filter in the outside air hood and in the return plenum air.

2.07 DAMPERS

A. Motorized Dampers: Provide motorized dampers at outside air inlet, exhaust air outlet, and supply air outlet.
   1. Type: Motorized two position low-leak.
   2. Blades: Insulated, single blade damper.

2.08 VIBRATION ISOLATION

A. Vibration Isolation: Provide whole unit vibration isolation with the energy recovery unit assembly.

B. Construct with appropriately-sized, seismic-rated, corrosion-resistant captive-spring isolators.

2.09 ROOF CURBS

A. Curbs: Provide full perimeter vibration-isolating roof curb fabricated from 10 gage aluminized steel.

2.10 POWER AND CONTROLS

A. Motor Control Panels: UL listed.

B. Include necessary motor starters, VFDs, fuses, transformers and overload protection according to NFPA 70.

C. Install wiring in accordance with NFPA 70.

2.11 ACCESSORIES

A. Electric Preheat Coil (Duct Mounted):
   1. Resistance coil type with elements enclosed in a steel sheath with fins and painted with a baked-on aluminum paint for long life in a 100% fresh air stream.
   2. Coil: UL listed and constructed in accordance with NFPA 70 requirements.
   3. Controls: Factory-provided SCR controls to maintain defined temperature (see schedule for details).

2.12 SERVICE ACCESSORIES

A. Switch: 2 type.
   1. Two Position Type: Service and Operate.

B. Electrical Components: Factory wired for single point power connection.
   1. Protect all integral wires and connections.
   2. Electrical Components: UL Listed.

PART 3 EXECUTION

3.01 EXAMINATION

3.02 INSTALLATION

A. Provide openings for suitable ductwork connection.

3.03 SYSTEM STARTUP

A. Provide services of manufacturer's authorized representative to provide start up of unit.

3.04 CLEANING

A. Clean filters, air plenums, interior and exposed-to-view surfaces prior to Substantial Completion.

END OF SECTION 23 72 23

SECTION 23 81 01
TERMINAL HEAT TRANSFER UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electric Baseboard Heaters

1.02 RELATED REQUIREMENTS

A. Section 23 05 13 - Motor Requirements for HVAC and Plumbing Equip.

B. Section 23 21 13 - Hydronic Piping.

C. Section 23 21 14 - Hydronic Specialties.

D. Section 23 09 93 - Sequence of Operations for HVAC Controls.

E. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections. Installation of room thermostats. Electrical supply to units.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide typical catalog of information including arrangements.

C. Shop Drawings:
   1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
   2. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
   3. Indicate mechanical and electrical service locations and requirements.,

D. Manufacturer's Instructions: Indicate installation instructions and recommendations.

E. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access or valving.

F. Operation and Maintenance Data: Include manufacturers descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

G. Warranty: Submit manufacturer's warranty and ensure forms have been completed in North Providence School Department's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum 5 years documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturers warranty for all motors.

C. Provide one year parts and labor warranty for enitre unit, from substitute and completion.

1.06 EXTRA MATERIALS

A. See Section 01 60 00 - Product Requirements, for additional provisions.

B. Provide three (3) sets of filters, with a final change immediately prior to occupancy.

PART 2 PRODUCTS

2.01 ELECTRIC BASEBOARD

A. Manufacturers:
   1. Marley Engineered Products; Model _____: www.marleymep.com/#sle.
   2. Slant/Fin Corporation; Model _____: www.slantfin.com/#sle.

3. Markel; Model _____.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Assembly: UL listed and labelled with terminal box and cover, and built-in controls.

C. Heating Elements: Enclosed copper tube, aluminum finned element of coiled nickel-chrome resistance wire centered in tubes and embedded in refractory material.

D. Enclosure: Minimum 0.030 inch steel with 7 inch high back and top of one piece; front panel, end panel, end caps, corners, and joiner pieces to snap together, and front panel easily removable. Provide full length damper.

E. Control: Wall mount remote thermostat w/ BAS interface

F. Electrical Characteristics:
1. See drawings

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install equipment exposed to finished areas after walls and ceiling are finished and painted. Do not damage equipment or finishes.

C. Protection: Provide finished cabinet units with protective covers during balance of construction.

D. Finned Tube Radiation: Locate on outside walls and run cover wall-to-wall unless otherwise indicated. Center elements under windows. Install 6' AFF in group toilet rooms. Install wall angles where units butt against walls.

3.02 CLEANING

A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

C. Install new filters.

END OF SECTION 23 81 01

SECTION 23 81 29

VARIABLE REFRIGERANT VOLUME (VRV, VRF) HVAC SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable refrigerant volume HVAC system includes:
   1. Outdoor/Condensing unit(s).
   2. Indoor/Evaporator units.
   3. Branch selector units.
   4. Refrigerant piping.
   5. Control panels.
   6. Control wiring.

1.02 RELATED REQUIREMENTS

A. Section 01 23 00 - Alternates: List of alternates relevant to this section.

B. Section 01 79 00 - Demonstration and Training.

C. Section 22 10 05 - Plumbing Piping: Condensate drain piping.

D. Section 23 08 00 - Commissioning of HVAC.

E. Section 23 23 00 - Refrigerant Piping and Specialties: Additional requirements for refrigerant piping system.

F. Section 26 27 17 - Equipment Wiring: Power connections to equipment.
   1. Provide separate power connections for each unit of equipment.

G. Section 23 09 23 and 23 09 93: Building automation system providing centralized control of this system.

1.03 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.

B. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals.

C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.

D. NFPA 70 - National Electrical Code.

E. UL 1995 - Heating and Cooling Equipment.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Pre-Bid Submittals: For proposed substitute systems/products, as defined in PART 2, and alternate systems/products, as defined above, proposer shall submit all data described in this article, under the terms given for substitutions stated in PART 2.

C. Design Data:
   1. Provide design calculations showing that system will achieve performance specified.
   2. Provide design data required by ASHRAE 90.1.

D. Product Data: Submit manufacturer's standard data sheets showing the following for each item of equipment, marked to correlate to equipment item markings shown in the contract documents:
   1. Control Panels: Complete description of options, control points, zones/groups.

E. Specimen Warranty: Copy of manufacturer's warranties.

F. Shop Drawings: Installation drawings custom-made for this project; include as-designed HVAC layouts, locations of equipment items, refrigerant piping sizes and locations, condensate piping sizes and locations, remote sensing devices, control components, electrical connections, control wiring connections. Include:
   1. Detailed piping diagrams, with branch balancing devices.
   2. Condensate piping routing, size, and pump connections.
   3. Detailed power wiring diagrams.
   4. Detailed control wiring diagrams.
   5. Locations of required access through fixed construction.
   6. Drawings required by manufacturer.

G. Operating and Maintenance Data:
   1. Manufacturer's complete standard instructions for each unit of equipment and control panel.
   2. Custom-prepared system operation, troubleshooting, and maintenance instructions and recommendations.
   3. Identification of replaceable parts and local source of supply.

H. Project Record Documents: Record the following:
   1. As-installed routing of refrigerant piping and condensate piping.
   2. Locations of access panels.
   3. Locations of control panels.

I. Warranty: Executed warranty, made out in Owner's name.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Company that has been manufacturing variable refrigerant volume heat pump equipment for at least 5 years.
   2. Company that provides system design software to installers.

B. Installer Qualifications: Trained and approved by manufacturer of equipment.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle equipment and refrigerant piping according to manufacturer's recommendations.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Compressors: Provide manufacturer's warranty for six (6) years from date of installation. During the stated period, should any part fail due to defects in material and workmanship, it shall be repaired or replaced by the manufacturer. All warranty service work shall be preformed by a factory trained service professional.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: The system design shown in the contract documents is based on equipment and system designed by Samsung Industries.

B. Additional acceptable manufacturers:
   1. Daikin AC: www.daikinac.com
   2. Mitsubishi: www.mitsubishi.com
   3. LG Industries: www.LG-vrf.com
   4. Samsung: www.www.samsungaccentre.com

C. For systems proposed by other manufacturers other than the basis of design, Samsung, <u>all</u> required modifications to the design and installation shall be the responsibility of the contractor and supplier for both costs and coordination with all other contractors and designers. These changes include, but are not limited to:

1. Changes in refrigerant piping sizes, legnhts, and locations.
2. Changes in branch selector quantities, locations, and accessibility.
3. Changes in electrical requirements, including all power wiring, terminations, breakers, disconnects, and control wiring.
4. Changes in heat-pump unit locations and quantities.
5. Changes in structural supports, vibration isolation, and hangers.
6. Changes to the drawings to reflect the new system parameters.

2.02 HVAC SYSTEM DESIGN

A. System Operation: Heating and cooling, simultaneously.
   1. Zoning: Provide capability for temperature control for each individual indoor/evaporator unit independently of all other units.
   2. Zoning: Provide heating/cooling selection for each individual indoor/evaporator unit independently of all other units.
   3. Provide a complete functional system that achieves the specified performance based on the specified design conditions and that is designed and constructed according to the equipment manufacturer's requirements.
   4. Conditioned spaces are shown on drawings.
   5. Branch selector unit locations are shown on the drawings for reference only. Final design locations shall be corrdinated in the field to ensure optimized line lengths and maintanence access.
   6. Required equipment unit capacities are shown on the drawings.
   7. Refrigerant piping sizes shown on the drawings are for general reference only. Final line sizing shall be the responsibility of the successful contractor and manufacturer.
   8. Connect equipment to condensate piping; condensate piping is shown on the drawings.

B. Outside Air Design Conditions:
   1. Summer Outside Air Design Temperature: 0.4 percent cooling design condition listed in ASHRAE Fundamentals Handbook.

C. Operating Temperature Ranges:
   1. Simultaneous Heating and Cooling Operating Range: minus 4 degrees F to 60 degrees F dry bulb.

D. Refrigerant Piping Lengths: Provide equipment capable of serving system with following piping lengths without any oil traps:
   1. Minimum Piping Length from Outdoor/Central Unit(s) to Furthest Terminal Unit: 540 feet, actual; 620 feet, equivalent.
   2. Total Combined Liquid Line Length: 3280 feet, minimum.
   3. Minimum Piping Length Between Indoor Units: 49 feet.

E. Controls: Provide the following control interfaces:
   1. For Each Indoor/Evaporator Unit: One wall-mounted wired "local" controller, with temperature sensor; locate where directed, in each space.
      a. Where two or more units are used to condition the same space, provide a splitter or twinning kit to allow for multiple unit control from a single controller.
      b. When units are mounted in a high-traffic or high impact area, provide remote flat-plate temperature sensor with tamper-resistant screws and mount local controller adjacent to unit in concealed area. Space include, corridors/stairwells, restrooms, mechanical rooms, gymnasiums, cafeterias, and entrance vestibules. See specification section 230913 for temperature sensor requirements.
   2. One central remote control panel for entire system; locate where indicated.
   3. BACNet gateways sufficient to connect all units to building automation system by others; include wiring to gateways. Unit shall be BTL certified.
   4. Building automation system by HVAC system manufacturer ; provide one user stations located where indicated.

F. Local Controllers: Mount units above ceiling for use with remote, flat-plate temerpature sensors. Units shall be wired, and provide local setpoint adjustment (with central control override, maximum temperature adjustment), and temperature display for trouble-shooting.

G. Remote Temperature Sensors: Provide wall-mounted, flush-mount flat-plate style RTD temperatuer sensors located in the same room for all units. For rooms with multiple units, provide twinning kits for simlutaneous control.

2.03 EQUIPMENT

A. All Units: Factory assembled, wired, and piped and factory tested for function and safety.
   1. Refrigerant: R-410A.
   2. Performance Certification: AHRI Certified; www.ahrinet.org.
   3. Safety Certification: Tested to UL 1995 by UL or Intertek-ETL and bearing the certification label.
   4. Provide outdoor/condensing units capable of serving indoor unit capacity up to 200 percent of the capacity of the outdoor/condensing unit.
   5. Provide units capable of serving the zones indicated.
   6. Thermal Performance: Provide heating and cooling capacity as indicated, based on the following nominal operating conditions:
   7. Energy Efficiency: Report EER and COP based on tests conducted at “full load” in accordance with AHRI 210/240 or alternate test method approved by U.S. Department of Energy.

B. Electrical Characteristics:
   1. See drawings.

C. System Controls:
   1. Include self diagnostic, auto-check functions to detect malfunctions and display the type and location.

D. Unit Controls: As required to perform input functions necessary to operate system; provided by manufacturer of units.
   1. Provide interfaces to remote control and building automation systems in BACNET native format.

E. Wiring:
   1. Control Wiring: 18 AWG, 2-conductor, non-shielded, non-polarized, stranded cable.
   2. Control Wiring Configuration: Daisy chain.
   3. All control wiring for the VRF system in it's entirety is the responsbility of the installing contractor, including, but not limited to: Wiring between the condensing unit(s) and system controller, wiring between the branch selector boxes and system controller, wiring from the terminal units to the system controllers, wiring from the thermostats to the terminal units. The BAS contractor shall only be required to provide communications wiring to the BACnet interface from the nearest BAS controller.

F. Refrigerant Piping:
   1. Refrigerant Flow Balancing: Provide refrigerant piping joints and headers specifically designed to ensure proper refrigerant balance and flow for optimum system capacity and performance.
   2. Insulate each refrigerant line individually between the condensing and indoor units.

2.04 OUTDOOR/CONDENSING UNITS

A. Outdoor/Condensing Units: Air-cooled DX refrigeration units, designed specifically for use with indoor/evaporator units; factory assembled and wired with all necessary electronic and refrigerant controls; modular design for ganging multiple units.
   1. Refrigeration Circuit: Scroll compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports and refrigerant regulator.
   2. Refrigerant: Factory charged.

3. Variable Volume Control: Modulate compressor capacity automatically to maintain constant suction and condensing pressures while varying refrigerant volume to suit heating/cooling loads.
4. Capable of being installed with wiring and piping to the left, right, rear or bottom.
5. Capable of heating operation at low end of operating range as specified, without additional low ambient controls or auxiliary heat source; during heating operation, reverse cycle (cooling mode) oil return or defrost is not permitted, due to potential reduction in space temperature.
6. Sound Pressure Level: As specified, measured at 3 feet from front of unit; provide night setback sound control as a standard feature; three selectable sound level steps of 55 dB, 50 dB, and 45 dB, maximum.
7. Power Failure Mode: Automatically restart operation after power failure without loss of programmed settings.
8. Safety Devices: High pressure sensor and switch, low pressure sensor/switch, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.
9. Provide refrigerant sub-cooling to ensure the liquid refrigerant does not flash when supplying to us indoor units.
10. Oil Recovery Cycle: Automatic, occurring 2 hours after start of operation and then every 8 hours of operation; maintain continuous heating during oil return operation.
11. Controls: Provide contacts for electrical demand shedding.

B. Unit Cabinet: Weatherproof and corrosion resistant; rust-proofed mild steel panels coated with baked enamel finish.
   1. Designed to allow side-by-side installation with minimum spacing.

C. Fans: One or more direct-drive propeller type, vertical discharge, with multiple speed operation via DC (digitally commutating) inverter.
   1. Provide minimum of 2 fans for each condensing unit.
   2. External Static Pressure: Factory set at 0.12 in WG, minimum.
   3. Indoor Mounted Air-Cooled Units: External static pressure field set at 0.32 in WG, minimum; provide for mounting of field-installed ducts.
   4. Fan Airflow: As indicated for specific equipment.
   5. Fan Motors: Factory installed; permanently lubricated bearings; inherent protection; fan guard; output as indicated for specific equipment.

D. Condenser Coils: Copper tubes expanded into aluminum fins to form mechanical bond; waffle louver fin and rifled bore tube design to ensure high efficiency performance.

E. Compressors: Scroll type, hermetically sealed, variable speed inverter-driven and fixed speed in combination to suit total capacity; minimum of one variable speed, inverter driven compressor per condenser unit; minimum of two compressors per condenser unit; capable of controlling capacity within range of 6 percent to 100 percent of total capacity.
   1. Multiple Condenser Modules: Balance total operation hours of compressors by means of duty cycling function, providing for sequential starting of each module at each start/stop cycle, completion of oil return, and completion of defrost, or every 8 hours. Provide twinning kits where required.
   2. Failure Mode: In the event of compressor failure, operate remaining compressor(s) at proportionally reduced capacity; provide microprocessor and associated controls specifically designed to address this condition.
   3. Provide each compressor with crankcase heater, high pressure safety switch, and internal thermal overload protector.
   4. Provide oil separators and intelligent oil management system.
   5. Provide spring mounted vibration isolators.

2.05 BRANCH SELECTOR UNITS

A. Branch Selector Units: Concealed boxes designed specifically for this type of system to control heating/cooling mode selection of downstream units; consisting of electronic expansion valves, subcooling heat exchanger, refrigerant control piping and electronics to facilitate communications between unit and main processor and between branch unit and indoor/evaporator units.
   1. Provide one electronic expansion valve for each downstream unit served, except multiple indoor/evaporator units may be connected, provided balancing joints are used in downstream piping and total capacity is within capacity range of the branch selector.
   2. When branch unit is simultaneously heating and cooling, energize subcooling heat exchanger.
   3. Casing: Galvanized steel sheet; with flame and heat resistant foamed polyethylene sound and thermal insulation.
   4. Refrigerant Connections: Braze type.
   5. Condensate Drainage: Provide condensate drain tap where required.

2.06 INDOOR/EVAPORATOR UNITS

A. All Indoor/Evaporator Units: Factory assembled and tested DX fan-coil units, with electronic proportional expansion valve, control circuit board, factory wiring and piping, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
   1. Refrigerant: Refrigerant circuits factory-charged with dehydrated air, for field charging.
   2. Temperature Control Mechanism: Return air thermistor and computerized Proportional-Integral-Derivative (PID) control of superheat.
   3. Dehumidification Function: On command.
   4. Coils: Direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond; waffle louver fin and high heat exchange, rifled bore tube design; factory tested.
      a. Provide thermistor on liquid and gas lines.
   5. Fans: Direct-drive, with statically and dynamically balanced impellers; high and low speeds unless otherwise indicated; motor thermally protected.
   6. Return Air Filter: High efficiency, MERV 13
   7. Condensate Drainage: Built-in condensate drain pan with PVC drain connection.
   8. Cabinet Insulation: Sound absorbing foamed polystyrene and polyethylene insulation.

B. Recessed Ceiling Units: Four-way airflow cassette with central return air grille, for installation in a fixed ceiling.
   1. Cabinet Height: Maximum of 10 inches above face of ceiling.
   2. Exposed Housing: White, impact resistant, with washable decoration panel.
   3. Supply Airflow Adjustment:
      a. Via motorized louvers which can be horizontally and vertically adjusted from 0 to 90 degrees.
      b. Field-modifiable to 3-way and 2-way airflow.
      c. Three auto-swing positions, including standard, draft prevention and ceiling stain prevention.
   4. Return Air Filter: High efficiency,MERV 13.
   5. Minimum Capacity: As indicated on drawings.
   6. Sound Pressure Range: Between 28 dB(A) to 33 dB(A) at low speed measured at 5 feet below the unit.
   7. Fan: Direct-drive turbo type, with motor output range of 0.06 to 0.12 HP.
   8. Condensate Pump: Built-in, with lift of 21 inches, minimum.
   9. Provide side-mounted fresh air intake duct connection.

C. Concealed-In-Ceiling Units: Ducted horizontal discharge and return; galvanized steel cabinet.
   1. Return Air Filter: MERV 13.
   2. Sound Pressure: Measured at low speed at 5 feet below unit.
   3. Provide external static pressure switch adjustable for high efficiency filter operation

4. Condensate Pump: Built-in, with lift of 9 inches, minimum.
5. Switch box accessible from side or bottom.

D. Ceiling Surface-Mounted Units: White, finished casing, with removable front grille; foamed polystyrene and polyethylene sound insulation, and mounting brackets; mildew-proof polystyrene drain pan.
1. Airflow Control: Auto-swing louver that closes automatically when unit stops; five (5) steps of discharge angle, set using remote controller; upon restart, discharge angle defaulting to same angle as previous operation.
2. Sound Pressure Range: Measured at high speed at 3.3 feet below and away from unit.
3. Condensate Pump: Built-in, concealed, wide drain connection concealed in ceiling.
4. Fan: Two-speed, direct-drive cross-flow type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that required electrical services have been installed and are in the proper locations prior to starting installation.

B. Verify that condensate piping has been installed and is in the proper location prior to starting installation.

C. Notify Architect if conditions for installation are unsatisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install refrigerant piping in accordance with equipment manufacturer's instructions.

C. Perform wiring in accordance with NFPA 70, National Electric Code (NEC).

D. Coordinate with installers of systems and equipment connecting to this system.

3.03 FIELD QUALITY CONTROL

A. Provide manufacturer's field representative to inspect installation prior to startup.

3.04 SYSTEM STARTUP

A. Provide manufacturer's field representative to perform system startup.

B. Prepare and start equipment and system in accordance with manufacturer's instructions and recommendations.

C. Adjust equipment for proper operation within manufacturer's published tolerances.

3.05 CLEANING

A. Clean exposed components of dirt, finger marks, and other disfigurements.

3.06 CLOSEOUT ACTIVITIES

A. Demonstrate proper operation of equipment to North Providence School Department's designated representative.

B. Demonstration: Demonstrate operation of system to North Providence School Department's personnel.
1. Use operation and maintenance data as reference during demonstration.
2. Briefly describe function, operation, and maintenance of each component.

C. Training: Train North Providence School Department's personnel on operation and maintenance of system.
1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.
3. Instructor: Manufacturer's training personnel.
4. Location: At project site.

3.07 PROTECTION

A. Protect installed components from subsequent construction operations.

B. Replace exposed components broken or otherwise damaged beyond repair.

3.08 MAINTENANCE

A. See Section 01 70 00 - Execution Requirements, for additional requirements relating to maintenance service.

END OF SECTION 23 81 29

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.

B. Underground feeder and branch-circuit cable.

C. Service entrance cable.

D. Armored cable.

E. Metal-clad cable.

F. Wiring connectors.

G. Electrical tape.

H. Heat shrink tubing.

I. Oxide inhibiting compound.

J. Wire pulling lubricant.

K. Cable ties.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 26 05 05 - Selective Demolition for Electrical: Disconnection, removal, and/or extension of existing electrical conductors and cables.

C. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 28 46 00 - Fire Detection and Alarm: Fire alarm system conductors and cables.

F. Section 31 23 16 - Excavation.

G. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.

H. Section 31 23 23 - Fill: Bedding and backfilling.

1.03 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire.

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes.

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation.

E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape.

F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction.

H. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC).

I. NECA 121 - Standard for Installing Nonmetallic-Sheathed Cable (Type NM-B) and Underground Feeder and Branch-Circuit Cable (Type UF).

J. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.

K. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

L. NFPA 70 - National Electrical Code.

M. UL 4 - Armored Cable.

N. UL 44 - Thermoset-Insulated Wires and Cables.

O. UL 83 - Thermoplastic-Insulated Wires and Cables.

P. UL 486A-486B - Wire Connectors.

Q. UL 486C - Splicing Wire Connectors.

R. UL 486D - Sealed Wire Connector Systems.

S. UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables.

T. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape.

U. UL 1569 - Metal-Clad Cables.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

C. Sustainable Design Documentation: Submit manufacturer's product data on conductor and cable showing compliance with specified lead content requirements.

D. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors. Include proposed modifications to raceways, boxes, wiring gutters, enclosures, etc. to accommodate substituted conductors.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductors for Grounding and Bonding: Also comply with Section 26 05 26.

H. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.

I. Conductor Material:
   1. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B 787M unless otherwise indicated.
   2. Tinned Copper Conductors: Comply with ASTM B33.

J. Minimum Conductor Size:
   1. Branch Circuits: 12 AWG.
      a. Exceptions:
         1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
         2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
         3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
   2. Control Circuits: 14 AWG.

K. Conductor Color Coding:
   1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
   2. Color Coding Method: Integrally colored insulation.
      a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
   3. Color Code:
      a. 480Y/277 V, 3 Phase, 4 Wire System:
         1) Phase A: Brown.
         2) Phase B: Orange.
         3) Phase C: Yellow.
         4) Neutral/Grounded: Gray.
      b. 208Y/120 V, 3 Phase, 4 Wire System:
         1) Phase A: Black.

2) Phase B: Red.
3) Phase C: Blue.
4) Neutral/Grounded: White.

c. Equipment Ground, All Systems: Green.
d. Isolated Ground, All Systems: Green with yellow stripe.
e. Travelers for 3-Way and 4-Way Switching: Pink.
f. For control circuits, comply with manufacturer's recommended color code.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
1. Copper Building Wire:
a. Cerro Wire LLC: www.cerrowire.com/#sle.
b. Southwire Company: www.southwire.com/#sle.
c. Houston Wire & Cable co.
d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
1. Feeders and Branch Circuits:
a. Size 10 AWG and Smaller: Solid.
b. Size 8 AWG and Larger: Stranded.
2. Control Circuits: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:
1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
a. Size 4 AWG and Larger: Type XHHW-2.
b. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.

2.04 UNDERGROUND FEEDER AND BRANCH-CIRCUIT CABLE

A. Manufacturers:
1. Cerro Wire LLC: www.cerrowire.com/#sle.
2. Southwire Company: www.southwire.com/#sle.
3. Houston Wire & Cable co..
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type UF multiple-conductor cable listed and labeled as complying with UL 493, Type UF-B.

C. Provide equipment grounding conductor unless otherwise indicated.

D. Conductor Stranding:
1. Size 10 AWG and Smaller: Solid.
2. Size 8 AWG and Larger: Stranded.

E. Insulation Voltage Rating: 600 V.

2.05 SERVICE ENTRANCE CABLE

A. Conductor Stranding: Stranded.

B. Insulation Voltage Rating: 600 V.

2.06 ARMORED CABLE

A. Manufacturers:
1. AFC Cable Systems Inc: www.afcweb.com/#sle.
2. Encore Wire Corporation: www.encorewire.com/#sle.
3. Southwire Company: www.southwire.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type AC cable listed and labeled as complying with UL 4, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid.
   2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN.

F. Grounding: Combination of interlocking armor and integral bonding wire.
   1. Provide additional full-size integral insulated equipment grounding conductor for redundant grounding, suitable for general purpose, non-essential electrical systems in non-hazardous patient care areas of health care facilities.

G. Armor: Steel, interlocked tape.

2.07 METAL-CLAD CABLE

A. Manufacturers:
   1. AFC Cable Systems Inc: www.afcweb.com/#sle.
   2. Encore Wire Corporation: www.encorewire.com/#sle.
   3. Southwire Company: www.southwire.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid.
   2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

F. Provide dedicated neutral conductor for each phase conductor where indicated or required.

G. Grounding: Full-size integral equipment grounding conductor.
   1. Provide additional isolated/insulated grounding conductor where indicated or required.

H. Armor: Steel, interlocked tape.

I. Provide PVC jacket applied over cable armor where indicated or required for environment of installed location.

2.08 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 26 05 26.

C. Wiring Connectors for Splices and Taps:
   1. Copper Conductors Sizes 10 and under: Use twist-on insulated spring connectors.
   2. Copper Conductors Sizes 8 and larger: Use mechanical connectors.

D. Wiring Connectors for Terminations:
   1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
   2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
   3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
   4. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. Ideal Industries, Inc: www.idealindustries.com/#sle.
      c. NSI Industries LLC: www.nsiindustries.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

H. Mechanical Connectors: Provide bolted type or set-screw type.
   1. Manufacturers:
      a. Burndy: www.burndy.com.
      b. Ilsco: www.ilsco.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

I. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
   1. Manufacturers:
      a. Burndy: www.burndy.com.
      b. Ilsco: www.ilsco.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

2.09 WIRING ACCESSORIES

A. Electrical Tape:
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. Plymouth Rubber Europa: www.plymouthrubber.com/#sle.
      c. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
      a. Product: 3 M.
      b. Substitutions: See Section 01 60 00 - Product Requirements.
   3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
      a. Product: 3 M.
      b. Substitutions: See Section 01 60 00 - Product Requirements.
   4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
   5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
   6. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil; suitable for continuous temperature environment up to 221 degrees F.
   7. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. Burndy: www.burndy.com.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
   1. Manufacturers:
      a. Burndy: www.burndy.com.
      b. Ideal Industries, Inc: www.idealindustries.com/#sle.
      c. Ilsco: www.ilsco.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

D. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. American Polywater Corporation: www.polywater.com/#sle.
      c. Ideal Industries, Inc: www.idealindustries.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

E. Cable Ties: Material and tensile strength rating suitable for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as shown on the drawings.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
   2. When circuit destination is indicated and routing is not shown, determine exact routing required.
   3. Arrange circuiting to minimize splices.
   4. Include circuit lengths required to install connected devices within 10 ft of location shown.
   5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
   6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
   7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are shown as separate, combining them together in a single raceway is not permitted.

B. Install products in accordance with manufacturer's instructions.

C. Install conductors and cable in a neat and workmanlike manner in accordance with NECA 1.

D. Install underground feeder and branch-circuit cable (Type UF-B) in accordance with NECA 121.

E. Install armored cable (Type AC) in accordance with NECA 120.

F. Install metal-clad cable (Type MC) in accordance with NECA 120.

G. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

H. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

I. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

J. Terminate cables using suitable fittings.
   1. Armored Cable (Type AC):
      a. Use listed fittings and anti-short, insulating bushings.
      b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
   2. Metal-Clad Cable (Type MC):
      a. Use listed fittings.
      b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

K. Install conductors with a minimum of 12 inches of slack at each outlet.

L. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.

M. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

N. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

O. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
   2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
   3. Do not remove conductor strands to facilitate insertion into connector.
   4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
   5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

P. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
   1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
      b. For taped connections likely to require re-entering, including motor leads, first apply varnished cambric electrical tape, followed by adequate amount of rubber splicing electrical tape, followed by outer covering of vinyl insulating electrical tape.

2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
    a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
    b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
3. Wet Locations: Use heat shrink tubing.

Q. Insulate ends of spare conductors using vinyl insulating electrical tape.

R. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

S. Identify conductors and cables in accordance with Section 26 05 53.

T. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

U. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION 26 05 19

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Ground rod electrodes.

F. Ground enhancement material.

G. Ground access wells.

H. Grounding and bonding components.

I. Provide all components necessary to complete the grounding system(s) consisting of:
   1. Existing metal underground water pipe.
   2. Metal frame of the building.
   3. Existing metal underground gas piping system.
   4. Metal underground gas piping system.

1.02 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

C. Section 26 56 00 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

1.03 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

E. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association.

F. NFPA 70 - National Electrical Code.

G. UL 467 - Grounding and Bonding Equipment.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify exact locations of underground metal water service pipe entrances to building.
   2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
   3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 25 ohms.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

C. Shop Drawings:

D. Product Data: Provide for grounding electrodes and connections.

E. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

F. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Project Record Documents: Record actual locations of grounding electrode system components and connections.

H. Project Record Documents: Record actual locations of components and grounding electrodes.

1.07 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

D. Grounding System Resistance:
   1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
   2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
   3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.

E. Grounding Electrode System:
   1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
      a. Provide continuous grounding electrode conductors without splice or joint.

b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.

2. Metal Underground Water Pipe(s):
   a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
   b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
   c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
3. Metal Building or Structure Frame:
   a. Provide connection to metal building or structure frame effectively grounded in accordance with NFPA 70 at nearest accessible location.
4. Ground Ring:
   a. Provide a ground ring encircling the building or structure consisting of bare copper conductor not less than 2 AWG in direct contact with earth, installed at a depth of not less than 30 inches.
   b. Where location is not indicated, locate ground ring conductor at least 24 inches outside building perimeter foundation.
   c. Provide ground enhancement material around conductor where indicated.
   d. Provide connection from ground ring conductor to:
      1) Perimeter columns of metal building frame.
      2) Ground rod electrodes located as indicated.
5. Ground Rod Electrode(s):
   a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
   b. Space electrodes not less than 10 feet from each other and any other ground electrode.
   c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
   d. Provide ground access well for each electrode.
6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.

F. Service-Supplied System Grounding:
1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

G. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.

4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
    a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
    b. Metal gas piping.
8. Provide bonding for interior metal air ducts.
9. Provide bonding for metal building frame where not used as a grounding electrode.

H. Isolated Ground System:
1. Where isolated ground receptacles or other isolated ground connections are indicated, provide separate isolated/insulated equipment grounding conductors.
2. Connect isolated/insulated equipment grounding conductors only to separate isolated/insulated equipment ground busses.
3. Connect the isolated/insulated equipment grounding conductors to the solidly bonded equipment ground bus only at the service disconnect or separately derived system disconnect. Do not make any other connections between isolated ground system and normal equipment ground system on the load side of this connection.

I. Pole-Mounted Luminaires: Also comply with Section 26 56 00.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
1. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in addition to requirements of Section 26 05 19:
1. Use insulated copper conductors unless otherwise indicated.
    a. Exceptions:
        1) Use bare copper conductors where installed underground in direct contact with earth.
        2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
    a. Exceptions:
        1) Use mechanical connectors for connections to electrodes at ground access wells.
3. Unless otherwise indicated, use exothermic welded connections for accessible connections.
    a. Exceptions:
        1) Use exothermic welded connections for connections to metal building frame.
4. Manufacturers - Mechanical and Compression Connectors:
    a. Advanced Lightning Technology (ALT): www.altfab.com/#sle.
    b. Burndy: www.burndy.com.
    c. Thomas & Betts Corporation: www.tnb.com/#sle.
    d. Substitutions: See Section 01 60 00 - Product Requirements.
5. Manufacturers - Exothermic Welded Connections:

a. Burndy: www.burndy.com.
b. Cadweld, a brand of Erico International Corporation: www.erico.com/#sle.
c. ThermOweld, a brand of Continental Industries, Inc: www.thermoweld.com/#sle.
d. Substitutions: See Section 01 60 00 - Product Requirements.

D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: As indicated.
3. Holes for Connections: As indicated or as required for connections to be made.
4. Manufacturers:
a. Advanced Lightning Technology (ALT): www.altfab.com/#sle.
b. Erico International Corporation: www.erico.com/#sle.
c. Harger Lightning & Grounding: www.harger.com/#sle.
d. ThermOweld, a brand of Continental Industries, Inc: www.thermoweld.com/#sle.
e. Substitutions: See Section 01 60 00 - Product Requirements.

E. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.
4. Manufacturers:
a. Advanced Lightning Technology (ALT): www.altfab.com/#sle.
b. Erico International Corporation: www.erico.com/#sle.
c. Galvan Industries, Inc: www.galvanelectrical.com/#sle.
d. Harger Lightning & Grounding: www.harger.com/#sle.
e. Substitutions: See Section 01 60 00 - Product Requirements.

F. Ground Enhancement Material:
1. Description: Factory-mixed conductive material designed for permanent and maintenance-free improvement of grounding effectiveness by lowering resistivity.
2. Resistivity: Not more than 20 ohm-cm in final installed form.
3. Manufacturers:
a. Erico International Corporation: www.erico.com/#sle.
b. Harger Lightning & Grounding: www.harger.com/#sle.
c. ThermOweld, a brand of Continental Industries, Inc: www.thermoweld.com.
d. Substitutions: See Section 01 60 00 - Product Requirements.

G. Ground Access Wells:
1. Description: Open bottom round or rectangular well with access cover for testing and inspection; suitable for the expected load at the installed location.
2. Size: As required to provide adequate access for testing and inspection, but not less than minimum size requirements specified.
a. Round Wells: Not less than 8 inches in diameter.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 10 inches.
4. Cover: Factory-identified by permanent means with word "GROUND".
5. Manufacturers:
a. Advanced Lightning Technology (ALT): www.altfab.com/#sle.
b. Erico International Corporation: www.erico.com/#sle.
c. Harger Lightning & Grounding: www.harger.com/#sle.
d. ThermOweld, a brand of Continental Industries, Inc: www.thermoweld.com.
e. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 MANUFACTURERS

A. Cooper Power Systems: www.cooperpower.com.

B. Framatome Connectors International: www.fciconnect.com.

C. Lightning Master Corporation: www.lightningmaster.com.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 CONNECTORS AND ACCESSORIES

A. Mechanical Connectors: Bronze.
   1. Substitutions: See Section 01 60 00 - Product Requirements.

B. Wire: Stranded copper.

C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as shown on the drawings.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify existing conditions prior to beginning work.

E. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install grounding and bonding system components in a neat and workmanlike manner in accordance with NECA 1.

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
   1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.

D. Make grounding and bonding connections using specified connectors.
   1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
   2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
   3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
   4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 26 05 53.

F. Provide bonding to meet requirements described in Quality Assurance.

G. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing. Each of branch circuits and feeder circuits shall have dedicated equipment grounding conductor, sharing this conductor with other grounding conductors is not permitted.

3.03 FIELD QUALITY CONTROL

A. Perform inspection in accordance with Section 01 40 00.

B. Inspect and test in accordance with NETA STD ATS except Section 4.

C. Perform inspections and tests listed in NETA STD ATS, Section 7.13.

D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION 26 05 26

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 05 50 00 - Metal Fabrications: Materials and requirements for fabricated metal supports.

C. Section 26 05 34 - Conduit: Additional support and attachment requirements for conduits.

D. Section 26 05 37 - Boxes: Additional support and attachment requirements for boxes.

E. Section 26 51 00 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

F. Section 26 56 00 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

D. MFMA-4 - Metal Framing Standards Publication.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction.

F. NFPA 70 - National Electrical Code.

G. UL 5B - Strut-Type Channel Raceways and Fittings.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

D. Installer's Qualifications: Include evidence of compliance with specified requirements.

E. Product Data: Provide manufacturer’s catalog data for fastening systems.

F. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

D. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.

E. Installer Qualifications for Field-Welding: As specified in Section 05 50 00.

F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Comply with the following. Where requirements differ, comply with most stringent.
      a. NFPA 70.
      b. Requirements of authorities having jurisdiction.
   2. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
   3. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated, where applicable.
   4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 1.5. Include consideration for vibration, equipment operation, and shock loads where applicable.
   5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
      c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Materials for Metal Fabricated Supports: Comply with Section 05 50 00.

C. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   2. Conduit Clamps: Bolted type unless otherwise indicated.
   3. Manufacturers:

a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
b. Erico International Corporation: www.erico.com/#sle.
c. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com/#sle.
d. Thomas & Betts Corporation: www.tnb.com/#sle.
e. Substitutions: See Section 01 60 00 - Product Requirements.

D. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
1. Manufacturers:
a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
b. Erico International Corporation: www.erico.com/#sle.
c. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com/#sle.
d. Thomas & Betts Corporation: www.tnb.com/#sle.
e. Substitutions: See Section 01 60 00 - Product Requirements.

E. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
1. Comply with MFMA-4.
2. Channel (Strut) Used as Raceway (only where specifically indicated): Listed and labeled as complying with UL 5B.
3. Channel Material:
a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
4. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch.
5. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.
6. Manufacturers:
a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
b. Thomas & Betts Corporation: www.tnb.com/#sle.
c. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
d. Substitutions: See Section 01 60 00 - Product Requirements.
e. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

F. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
a. Equipment Supports: 1/2 inch diameter.
b. Single Conduit up to 1 inch (27mm) trade size: 1/4 inch diameter.
c. Single Conduit larger than 1 inch (27mm) trade size: 3/8 inch diameter.
d. Trapeze Support for Multiple Conduits: 3/8 inch diameter.
e. Outlet Boxes: 1/4 inch diameter.
f. Luminaires: 1/4 inch diameter.

G. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Powder-actuated fasteners are not permitted.
9. Hammer-driven anchors and fasteners are not permitted.

10. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Comply with MFMA-4.
    b. Channel Material: Use galvanized steel.
    c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

2.02 MANUFACTURERS

A. Thomas & Betts Corporation: www.tnb.com.

B. Threaded Rod Company: www.threadedrod.com.

C. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 MATERIALS

A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.

B. Supports: Fabricated of structural steel or formed steel members; galvanized.

C. Anchors and Fasteners:
    1. Do not use powder-actuated anchors.
    2. Obtain permission from Architect before using powder-actuated anchors.
    3. Concrete Structural Elements: Use precast inserts.
    4. Steel Structural Elements: Use beam clamps.
    5. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
    6. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use hollow wall fasteners.
    7. Solid Masonry Walls: Use expansion anchors.
    8. Sheet Metal: Use sheet metal screws.
    9. Wood Elements: Use wood screws.

D. Formed Steel Channel:
    1. Product: manufactured by [B-Line.
    2. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install support and attachment components in a neat and workmanlike manner in accordance with NECA 1.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:
    1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
    2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.

3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Conduit Support and Attachment: Also comply with Section 26 05 34.

I. Box Support and Attachment: Also comply with Section 26 05 37.

J. Interior Luminaire Support and Attachment: Also comply with Section 26 51 00.

K. Exterior Luminaire Support and Attachment: Also comply with Section 26 56 00.

L. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

M. Secure fasteners according to manufacturer's recommended torque settings.

N. Remove temporary supports.

O. Identify independent electrical component support wires above accessible ceilings (only where specifically indicated or permitted) with color distinguishable from ceiling support wires in accordance with NFPA 70.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 26 05 29

SECTION 26 05 34

CONDUIT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Flexible metal conduit (FMC).

C. Liquidtight flexible metal conduit (LFMC).

D. Electrical metallic tubing (EMT).

E. Rigid polyvinyl chloride (PVC) conduit.

F. Conduit fittings.

G. Accessories.

H. Conduit, fittings and conduit bodies.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete encasement of conduits.

B. Section 07 84 00 - Firestopping.

C. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Metal clad cable (Type MC), armored cable (Type AC), and manufactured wiring systems, including uses permitted.

D. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

E. Section 26 05 29 - Hangers and Supports for Electrical Systems.

F. Section 26 05 53 - Identification for Electrical Systems.

G. Section 26 05 37 - Boxes.

H. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

I. Section 31 23 16 - Excavation.

J. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC).

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S).

C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A).

D. NECA 1 - Standard for Good Workmanship in Electrical Construction.

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT).

F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC).

G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.

H. NFPA 70 - National Electrical Code.

I. UL 1 - Flexible Metal Conduit.

J. UL 6 - Electrical Rigid Metal Conduit-Steel.

K. UL 360 - Liquid-Tight Flexible Steel Conduit.

L. UL 514B - Conduit, Tubing, and Cable Fittings.

M. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings.

N. UL 797 - Electrical Metallic Tubing-Steel.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
   4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

C. Shop Drawings:
   1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
   2. Include proposed locations of roof penetrations and proposed methods for sealing.

D. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch (53 mm) trade size and larger.

E. Product Data: Provide for metallic conduit and flexible metal conduit.

F. Samples of Materials Actually Delivered to Site:
   1. Two pieces each of conduit, 2 feet long.

G. Project Record Documents: Accurately record actual routing of conduits larger than 2 inches.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

D. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

D. Protect PVC conduit from sunlight.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:
   1. Under Slab on Grade: Use rigid PVC conduit.
   2. Exterior, Direct-Buried: Use rigid PVC conduit.
   3. Exterior, Embedded Within Concrete: Use rigid PVC conduit.
   4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
   5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.

D. Embedded Within Concrete:

E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit.

F. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT).

H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.

I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit.

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit.
   1. Locations subject to physical damage include, but are not limited to:
      a. Where exposed below 8 feet, except within electrical and communication rooms or closets.

K. Exposed, Exterior: Use galvanized steel rigid metal conduit.

L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit.

M. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
   1. Maximum Length: 6 feet.

N. Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit.
   2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
   3. Maximum Length: 6 feet unless otherwise indicated.
   4. Vibrating equipment includes, but is not limited to:
      a. Transformers.
      b. Motors.
      c. HVAC equipment.

O. Fished in Existing Walls, Where Necessary: Use flexible metal conduit.

2.02 CONDUIT REQUIREMENTS

A. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

B. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.

C. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuits: 3/4 inch (21 mm) trade size.
   2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
   3. Control Circuits: 1/2 inch (16 mm) trade size.

4. Flexible Connections to Luminaires: 1/2 inch (16 mm) trade size.
5. Underground, Interior: 3/4 inch (21 mm) trade size.
6. Underground, Exterior: 1 inch (27 mm) trade size.

D. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
1. Allied Tube & Conduit: www.alliedeg.com/#sle.
2. Republic Conduit: www.republic-conduit.com/#sle.
3. Wheatland Tube Company: www.wheatland.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.
d. Substitutions: See Section 01 60 00 - Product Requirements.
2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 METAL CONDUIT

A. Manufacturers:
1. Allied Tube & Conduit: www.alliedtube.com.
2. Beck Manufacturing, Inc: www.beckmfg.com.
3. Wheatland Tube Company: www.wheatland.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Rigid Steel Conduit: ANSI C80.1.

C. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.

2.05 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
2. Electri-Flex Company: www.electriflex.com/#sle.
3. International Metal Hose: www.metalhose.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.
d. Substitutions: See Section 01 60 00 - Product Requirements.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

3. Material: Use steel or malleable iron.

D. Description: Interlocked steel construction.

E. Fittings: NEMA FB 1.

2.06 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
   1. AFC Cable Systems, Inc; _____: www.afcweb.com/#sle.
   2. Electri-Flex Company; _____: www.electriflex.com/#sle.
   3. International Metal Hose; _____: www.metalhose.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
      b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.

2.07 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
   1. Allied Tube & Conduit; _____: www.alliedeg.com/#sle.
   2. Republic Conduit: www.republic-conduit.com/#sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
      b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.
   4. Connectors and Couplings: Use compression (gland) or set-screw type.
      a. Do not use indenter type connectors and couplings.
   5. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.
   6. Embedded Within Concrete (where permitted): Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

2.08 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
   1. Cantex Inc: www.cantexinc.com/#sle.
   2. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com/#sle.
   3. JM Eagle: www.jmeagle.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.09 ACCESSORIES

A. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

B. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

C. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.

D. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.

E. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify routing and termination locations of conduit prior to rough-in.

E. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in a neat and workmanlike manner in accordance with NECA 1.

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

E. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. When conduit destination is indicated and routing is not shown, determine exact routing required.
   3. Conceal all conduits unless specifically indicated to be exposed.
   4. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Electrical rooms.
      b. Mechanical equipment rooms.
      c. Within joists in areas with no ceiling.
   5. Arrange conduit to maintain adequate headroom, clearances, and access.
   6. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
   7. Arrange conduit to provide no more than 150 feet between pull points.
   8. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
   9. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
   10. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:

a. Heaters.
b. Hot water piping.
c. Flues.

11. Group parallel conduits in the same area together on a common rack.

F. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
4. Use conduit strap to support single surface-mounted conduit.
   a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
7. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
8. Use of spring steel conduit clips for support of conduits is not permitted.
9. Use of wire for support of conduits is not permitted.
   a. For securing conduits to studs in hollow stud walls.
   b. For suspending conduits supported by spring steel conduit clips (only where specifically indicated or permitted).

G. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

H. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.

8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

I. Underground Installation:
   1. Provide trenching and backfilling in accordance with Section 31 23 16.13.
   2. Minimum Cover, Unless Otherwise Indicated or Required:
      a. Underground, Exterior: 24 inches.
      b. Under Slab on Grade: 12 inches to bottom of slab.
   3. Provide underground warning tape in accordance with Section 26 05 53 along entire conduit length.

J. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 03 30 00 with minimum concrete cover of 3 inches on all sides unless otherwise indicated.

K. Hazardous (Classified) Locations: Where conduits cross boundaries of hazardous (classified) locations, provide sealing fittings located as indicated or in accordance with NFPA 70.

L. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
   1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
   2. Where conduits are subject to earth movement by settlement or frost.

M. Conduit Sealing:
   1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
      a. Where conduits enter building from outside.
      b. Where service conduits enter building from underground distribution system.
      c. Where conduits enter building from underground.
      d. Where conduits may transport moisture to contact live parts.
   2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
      a. Where conduits pass from outdoors into conditioned interior spaces.
      b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

N. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
   1. Where conduits pass from outdoors into conditioned interior spaces.
   2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

O. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

P. Provide grounding and bonding in accordance with Section 26 05 26.

Q. Identify conduits in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

3.06 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

B. Route conduit through roof openings for piping and ductwork wherever possible. Where separate roofing penetration is required, coordinate location and installation method with roofing installation specified in Section roofing section.

END OF SECTION 26 05 34

SECTION 26 05 37
BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Wall and ceiling outlet boxes.

D. Floor boxes.

E. Pull and junction boxes.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 29 - Hangers and Supports for Electrical Systems.

D. Section 26 27 26 - Wiring Devices:
   1. Wall plates.

E. Section 26 27 16 - Electrical Cabinets and Enclosures.

F. Section 26 27 26 - Wiring Devices: Wall plates in finished areas, floor box service fittings, fire-rated poke-through fittings, and access floor boxes.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

E. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

G. NFPA 70 - National Electrical Code.

H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations.

I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations.

J. UL 508A - UL Standard for Safety Industrial Control Panels.

K. UL 514A - Metallic Outlet Boxes.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
   4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
   5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
   6. Coordinate the work with other trades to preserve insulation integrity.

7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Project Record Documents: Record actual locations and mounting heights of outlet, pull, and junction boxes on project record documents.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:
1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use suitable concrete type boxes where flush-mounted in concrete.
4. Use suitable masonry type boxes where flush-mounted in masonry walls.
5. Use raised covers suitable for the type of wall construction and device configuration where required.
6. Use shallow boxes where required by the type of wall construction.
7. Do not use "through-wall" boxes designed for access from both sides of wall.
8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
12. Wall Plates: Comply with Section 26 27 26.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
3. Junction and Pull Boxes Larger Than 100 cubic inches:
   a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

2.02 MANUFACTURERS

A. Appleton Electric: www.appletonelec.com.

B. Steel City

C. Substitutions: Reco, Inc. See Section 01 60 00 - Product Requirements.

2.03 OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
   1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.
   2. Concrete Ceiling Boxes: Concrete type.

B. Nonmetallic Outlet Boxes: NEMA OS 2.

C. Cast Boxes: NEMA FB 1, Type FD, aluminum. Provide gasketed cover by box manufacturer. Provide threaded hubs.

D. Wall Plates for Finished Areas: As specified in Section 26 27 26.

2.04 FLOOR BOXES

A. Floor Boxes: NEMA OS 1, fully adjustable, _4 inches deep.

B. Material: Cast metal.

C. Shape: Rectangular.

D. Service Fittings: As specified in Section 26 27 26.

2.05 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

B. Hinged Enclosures: As specified in Section 26 27 16.

C. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:
   1. Material: Galvanized cast iron; Cast Aluminum.
   2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

D. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:
   1. Material: Galvanized cast iron; Cast Aluminum.
   2. Cover: Nonskid cover with neoprene gasket and stainless steel cover screws.
   3. Cover Legend: "ELECTRIC".

PART 3 EXECUTION

3.01 EXAMINATION

3.02

A. Verify that field measurements are as shown on drawings.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify locations of floor boxes and outlets in offices and work areas prior to rough-in.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Box Supports:

1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.

E. Install boxes plumb and level.

F. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

G. Install boxes as required to preserve insulation integrity.

H. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

I. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

J. Close unused box openings.

K. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

L. Provide grounding and bonding in accordance with Section 26 05 26.

M. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1.

N. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.

O. Coordinate installation of outlet boxes for equipment connected under Section 26 27 17.

P. Set wall mounted boxes at elevations to accommodate mounting heights indicated.

Q. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.
1. Adjust box locations up to 10 feet if required to accommodate intended purpose.

R. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.

S. Maintain headroom and present neat mechanical appearance.

T. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

U. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

V. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

W. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

X. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.

Y. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

Z. Use flush mounting outlet box in finished areas.

AA. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

AB. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches separation. Provide minimum 24 inches separation in acoustic rated walls.

AC. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

AD. Use stamped steel bridges to fasten flush mounting outlet box between studs.

AE. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

AF. Use adjustable steel channel fasteners for hung ceiling outlet box.

AG. Do not fasten boxes to ceiling support wires.

AH. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.

AI. Use gang box where more than one device is mounted together. Do not use sectional box.

AJ. Use gang box with plaster ring for single device outlets.

AK. Use cast outlet box in exterior locations exposed to the weather and wet locations.

AL. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.

AM. Set floor boxes level.

AN. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

3.04 ADJUSTING

A. Adjust floor boxes flush with finish flooring material.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closures in unused box openings.

3.05 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.06 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION 26 05 37

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Warning signs and labels.

F. Field-painted identification of conduit.

1.02 RELATED REQUIREMENTS

A. Section 09 90 00 - Painting and Coating.

1.03 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels.

C. NFPA 70 - National Electrical Code.

D. UL 969 - Marking and Labeling Systems.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

B. Product Data: Provide catalog data for nameplates, labels, and markers.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.06 EXTRA MATERIALS

A. See Section 01 60 00 - Product Requirements for additional requirements.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.

B. Identification for Conductors and Cables:
   1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
   2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

2.02 MANUFACTURERS

A. Brady Corporation: www.bradycorp.com.

B. Seton Identification Products: www.seton.com/aec.

C. HellermannTyton: www.hellermanntyton.com.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
   1. Materials:
   2. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
   1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
   2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Nameplates: Engraved three-layer laminated plastic, black letters on white background.

D. Locations:
   1. Each electrical distribution and control equipment enclosure.
   2. Communication cabinets.
   3. Disconnect switches, and starters.

E. Letter Size:
   1. Use 1/8 inch letters for identifying individual equipment and loads.
   2. Use 1/4 inch letters for identifying grouped equipment and loads.

2.04 WIRE AND CABLE MARKERS

A. Manufacturers:
   1. Panduit Corp.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

F. Minimum Text Height: 1/8 inch.

G. Color: Black text on white background unless otherwise indicated.

H. Description: split sleeve type wire markers.

I. Locations: Each conductor at panelboard gutters, pull boxes, outlet boxes, and junction boxes each load connection.

J. Legend:
   1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
   2. Control Circuits: Control wire number indicated on shop drawings.

2.05 VOLTAGE MARKERS

A. Manufacturers: Panduit Corp
   1. Substitutions: See Section 01 60 00 - Product Requirements.

B. Minimum Size:
   1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
   2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
   3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
   4. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

C. Legend:
   1. Markers for Voltage Identification: Highest voltage present.
   2. Markers for System Identification:

a. Emergency Power System: Text "EMERGENCY".
b. Other Systems: Type of service.

D. Color: Black text on orange background unless otherwise indicated.

E. Location: Furnish markers for each conduit longer than 6 feet.

F. Spacing: 20 feet on center.

G. Color:
1. 480 Volt System: Brown.
2. 208 Volt System: Yellow.
3. Fire Alarm System: Red.

H. Legend:
1. 480 Volt System: brown.
2. 208 Volt System: yellow.
3. Fire Alarm System: red.

2.06 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
1. Materials:
2. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. Warning Labels:
1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

B. Degrease and clean surfaces to receive nameplates and labels.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
1. Surface-Mounted Equipment: Enclosure front.
2. Flush-Mounted Equipment: Inside of equipment door.
3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Interior Components: Legible from the point of access.
6. Conductors and Cables: Legible from the point of access.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

END OF SECTION 26 05 53

SECTION 26 05 73

OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Short circuit study.

B. Coordination study and analysis.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Study reports, stamped or sealed and signed by study preparer.

C. Study Report: Submit protective device studies as specified, prior to submission of product data submittals or ordering or fabrication of protective devices.
   1. Include stamp or seal and signature of preparing engineer.

1.03 PROTECTIVE DEVICE STUDY

A. Analyze the specific electrical and utilization equipment (according to NEC definition), the actual protective devices to be used, and the actual feeder lengths to be installed.
   1. Study Methodology: Comply with requirements and recommendations of NFPA 70, IEEE 399, and IEEE 242.
   2. Report: State the methodology and rationale employed in making each type of calculation; identify computer software package(s) used.

B. One-Line Diagrams: Prepare schematic drawing of electrical distribution system, with all electrical equipment and wiring to be protected by the protective devices; identify nodes on the diagrams for reference on report that includes:
   1. Calculated fault impedance, X/R ratios, utility contribution, and short circuit values (asymmetric and symmetric) at the main switchboard bus and all downstream devices containing protective devices.
   2. Breaker and fuse ratings.
   3. Transformer kVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.
   4. Identification of each bus, with voltage.
   5. Conduit materials, feeder sizes, actual lengths, and X/R ratios.

C. Short Circuit Study: Calculate the fault impedance to determine available 3-phase short circuit and ground fault currents at each bus and piece of equipment during normal conditions, alternate operations, emergency power conditions, and other operations that could result in maximum fault conditions.
   1. Show fault currents available at key points in the system down to a fault current of 7,000 A at 480 V and 208 V.
   2. Include motor contributions in determining the momentary and interrupting ratings of the protective devices.
   3. Report: Include all pertinent data used in calculations and for each device include:
      a. Device identification.
      b. Protective device.
      c. Device rating.
      d. Calculated short circuit current, asymmetrical and symmetrical, and ground fault current.

D. Coordination Study: Perform an organized time-current analysis of each protective device in series from the individual device back to the primary source, under normal conditions, alternate operations, and emergency power conditions.
   1. Graphically illustrate that adequate time separation exists between series devices, including upstream primary device.
   2. Plot the specific time-current characteristics of each protective device on log-log paper.

3. Organize plots so that all upstream devices are clearly depicted on one sheet.
4. Also show the following on curve plot sheets:
    a. Device identification.
    b. Voltage and current transformer ratios for curves.
    c. 3-phase and 1-phase ANSI damage curves for each transformer.
    d. No-damage, melting, and clearing curves for fuses.
    e. Cable damage curves.
    f. Transformer inrush points.
    g. Maximum short circuit cutoff point.
    h. Simple one-line diagram for the portion of the system that each curve plot illustrates.
    i. Software report for each curve plot, labeled for identification.

E. Analysis: Determine ratings and settings of protective devices to minimize damage caused by a fault and so that the protective device closest to the fault will open first.
1. Required Ratings and Settings: Derive required ratings and settings of protective devices in consideration of upstream protective device settings and optimize system to ensure selective coordination.
2. Identify any equipment that is underrated as specified.
3. Identify specified protective devices that will not achieve required protection or coordination and cannot be field adjusted to do so, and for which adequate devices would involve a change to the contract sum.
4. In all cases where adequate protection or coordination cannot be achieved at no extra cost to North Providence School Department, provide a discussion of alternatives and logical compromises for best achievable coordination.

F. Protective Device Rating and Setting Chart: Summarize in tabular format the required characteristics for each protective device based on the analysis; include:
1. Device identification.
2. Relay CT ratios, tap, time dial, and instantaneous pickup.
3. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.
4. Fuse rating and type.
5. Ground fault pickup and time delay.
6. Input level and expected response time at two test points that are compatible with commonly available test equipment and the ratings of the protective device.
7. Highlight all devices that as furnished by Owners Project Manager will not achieve required protection.

1.04 QUALITY ASSURANCE

A. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.

B. Owners Project Manager Responsibility: Provide all project-related data needed by study preparer, including equipment, wire sizes, insulation types, conduit types, and actual circuit lengths.

C. North Providence School Department's Responsibility: Provide data on relevant North Providence School Department power distribution equipment.

END OF SECTION 26 05 73

SECTION 26 09 19
ENCLOSED CONTACTORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General purpose contactors.

B. Lighting contactors.

1.02 RELATED REQUIREMENTS

A. Section 26 05 29 - Hangers and Supports for Electrical Systems.

B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

C. Section 26 28 13 - Fuses.

1.03 REFERENCE STANDARDS

A. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.

B. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.

C. NEMA ICS 6 - Industrial Control and Systems: Enclosures.

D. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum).

E. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

F. NFPA 70 - National Electrical Code.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide dimensions, size, voltage ratings and current ratings.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Maintenance Data: Include instructions for replacing and maintaining coil and contacts.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Allen-Bradley/Rockwell Automation: www.ab.com/#sle.

B. Eaton Corporation; Cutler-Hammer Products: www.eaton.com/#sle.

C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 GENERAL PURPOSE CONTACTORS

A. Description: NEMA ICS 2, AC general purpose magnetic contactor.

B. Coil operating voltage: 120 volts, 60 Hertz.

C. Poles: As required to match circuit configuration and control function.

D. Enclosure: NEMA ICS 6, Type 1.

E. Accessories:
   1. Selector Switch: ON/OFF/AUTOMATIC.
   2. Indicating Light: RED.
   3. Auxiliary Contacts: One, normally open.

2.03 LIGHTING CONTACTORS

A. Description: NEMA ICS 2, magnetic lighting contactor.

B. Configuration: Mechanically held, 3 wire control.

C. Coil operating voltage: 120 volts, 60 Hertz.

D. Poles: As required to match circuit configuration and control function.

E. Contact Rating: Match branch circuit overcurrent protection, considering derating for continuous loads.

F. Enclosure: NEMA ICS 6, Type 1.

G. Accessories:
   1. Selector Switch: ON/OFF/AUTOMATIC.
   2. Indicating Light: RED.
   3. Auxiliary Contacts: One, normally open.

2.04 ACCESSORIES

A. Auxiliary Contacts: NEMA ICS 2, 2 normally open contacts in addition to seal-in contact.

B. Cover Mounted Pilot Devices: NEMA ICS 5, oiltight type.

C. Pilot Device Contacts: NEMA ICS 5, Form Z, rated A150.

D. Pushbuttons: Lockable type.

E. Indicating Lights: , LED type.

F. Selector Switches: Rotary type.

G. Relays: NEMA ICS 2, .

H. Control Power Transformers: 120 volt secondary, 50 VA minimum, in each enclosed contactor. Provide fused primary and secondary, and bond unfused leg of secondary to enclosure.

2.05 DISCONNECTS

A. Combination Contactors: Combine contactor with disconnect in common enclosure.

B. Disconnects: Thermal magnetic circuit breaker with integral thermal and instantaneous magnetic trip in each pole; UL listed.

C. Disconnects: Fusible switch assembly; NEMA KS 1, enclosed knife switch with externally operable handle. Fuse clips: Designed to accommodate Class R fuses.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install enclosed contactors where indicated, in accordance with manufacturer's instructions.

B. Install enclosed contactors plumb. Provide supports in accordance with Section 26 05 29.

C. Height: 5 ft to operating handle.

D. Provide fuses for fusible switches; refer to Section 26 28 13 for product requirements.

E. Provide engraved plastic nameplates; refer to Section 26 05 53 for product requirements and location.

3.02 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 40 00.

B. Inspect and test in accordance with NETA STD ATS, except Section 4.

C. Perform applicable inspections and tests listed in NETA STD ATS, Section 7.16.1.

END OF SECTION 26 09 19

SECTION 26 09 23
LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Occupancy sensors.

B. Time switches.

C. In-wall interval timers.

D. Outdoor photo controls.

E. Daylighting controls.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 37 - Boxes.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 09 19 - Enclosed Contactors: Lighting contactors.

F. Section 26 09 43 - Network Lighting Controls - Lutron.

G. Section 26 27 26 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, fan speed controllers, and wall plates.

H. Section 26 51 00 - Interior Lighting.

I. Section 26 56 00 - Exterior Lighting.

J. Section 01 91 00 - Commissioning

K. Section 01 91 10 - Functional Testing Procedures

L. Section 23 08 10 - Control Systems Commissioning

1.03 REFERENCE STANDARDS

A. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction.

C. NECA 130 - Standard for Installing and Maintaining Wiring Devices.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. NFPA 70 - National Electrical Code.

F. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control.

G. UL 916 - Energy Management Equipment.

H. UL 917 - Clock-Operated Switches.

I. UL 1472 - Solid-State Dimming Controls.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.

3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
5. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:
1. Do not install lighting control devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

C. Shop Drawings:
1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.
2. Daylighting Controls: Provide lighting plan indicating location, model number, and orientation of each photo sensor and associated system component.

D. Field Quality Control Reports.

E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data: Include detailed information on device programming and setup.

G. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for all occupancy sensors.

C. Provide two year manufacturer warranty for all daylighting controls.

PART 2 PRODUCTS

2.01 ALL LIGHTING CONTROL DEVICES

A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

C. Products for Switching of Electronic Fluorescent Ballasts: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

2.02 OCCUPANCY SENSORS

A. Manufacturers:
   1. Hubbell Building Automation, Inc: www.hubbellautomation.com
   2. Lutron Electronics Company, Inc: www.lutron.com/#sle.
   3. Sensor Switch Inc: www.sensorswitch.com/#sle.
   4. WattStopper: www.wattstopper.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.
   6. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. All Occupancy Sensors:
   1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
   2. Sensor Technology:
      a. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
   3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
   4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
   5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
   6. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
   7. Sensitivity: Field adjustable.
   8. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
   9. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
   10. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings.

C. Wall Switch Occupancy Sensors:
   1. All Wall Switch Occupancy Sensors:
      a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
      b. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).

c. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.

2. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.
   a. Products:
      1) Hubbell Building Automation.
      2) Watt Stopper.
      3) Sensor switch.
      4) Substitutions: See Section 01 60 00 - Product Requirements.

D. Wall Dimmer Occupancy Sensors:
   1. General Requirements:
      a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated dimming control capability , and no leakage current to load in off mode.
      b. Manual-Off Override Control Capability: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
      c. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.
      d. Provide field adjustable dimming preset for occupied state.

E. Ceiling Mounted Occupancy Sensors:
   1. All Ceiling Mounted Occupancy Sensors:
      a. Description: Low profile occupancy sensors designed for ceiling installation.
      b. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
      c. Provide field selectable setting for disabling LED motion detector visual indicator.
      d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
      e. Finish: White unless otherwise indicated.
   2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
      a. Standard Range Sensors: Capable of detecting motion within an area of 2000 sqft at a mounting height of 9 feet, with a field of view of 360 degrees.
         1) Products:
            (a) Hubbell Building Automation.
            (b) Sensor Switch.
            (c) Watt Stopper.
            (d) Substitutions: See Section 01 60 00 - Product Requirements.

F. Power Packs for Low Voltage Occupancy Sensors:
   1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
   2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
   3. Input Supply Voltage: Dual rated for 120/277 V ac.
   4. Load Rating:
      a. Incandescent Load: Not less than 15 A.
      b. Fluorescent Load: Not less than 20 A.
      c. Motor Load: Not less than 1 HP.

2.03 TIME SWITCHES

A. Manufacturers:

1. Intermatic, Inc: www.intermatic.com/#sle.
2. Paragon, a brand of Invensys Controls: www.invensyscontrols.com.
3. Tork, a division of NSI Industries LLC: www.tork.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.
5. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. Digital Electronic Time Switches:
1. Description: Factory-assembled solid state programmable controller with LCD display, listed and labeled as complying with UL 916 or UL 917.
2. Program Capability:
   a. Astronomic Time Switches: Single channel, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days and field-configurable astronomic feature to automatically adjust for seasonal changes in sunrise and sunset times.
3. Schedule Capacity: Not less than 16 programmable on/off operations.
4. Provide automatic daylight savings time and leap year compensation.
5. Provide power outage backup to retain programming and maintain clock.
6. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
7. Provide remote photocell input with light level adjustment.
8. Input Supply Voltage: As indicated on the drawings.
9. Output Switch Contact Ratings:
   a. Resistive Load: Not less than 30 A at 120-277 V ac.
   b. Tungsten Load: Not less than 5 A at 120 V ac.
   c. Inductive Load: Not less than 30 A at 120-277 V ac.
   d. Ballast Load: Not less than 20 A at 120 V ac or 6 A at 277 V ac.
   e. Motor Load: Not less than 1 HP at 120 V ac or 2 HP at 240 V ac.
10. Provide lockable enclosure; environmental type per NEMA 250 as specified for the following installation locations:
   a. Indoor clean, dry locations: Type 1.

C. Electromechanical Time Switches:
1. Description: Factory-assembled controller with motor-operated timing dial mechanism and adjustable trippers for setting on/off operations, listed and labeled as complying with UL 917.
2. Program Capability:
   a. 24-Hour Time Switches: With same schedule for each day of the week and skip-a-day feature to omit selected days.
3. Schedule Capacity:
   a. 24-Hour Time Switches: Accommodating not less than 12 pairs of selected on/off operations per day.
4. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
5. Input Supply Voltage: As indicated on the drawings.
6. Output Switch Configuration: As required to control the load indicated on drawings.
7. Output Switch Configuration: SPST dry unpowered maintained contacts.
8. Output Switch Contact Ratings: As required to control the load indicated on drawings.
9. Output Switch Contact Ratings:
   a. Resistive Load: Not less than 40 A at 120-277 V ac.
   b. Tungsten Load: Not less than 40 A at 120 V ac.
   c. Inductive Load: Not less than 20 A at 120-277 V ac.
   d. Motor Load: Not less than 1 HP at 120 V ac or 2 HP at 240 V ac.
10. Provide lockable enclosure; environmental type per NEMA 250 as specified for the following installation locations:

2.04 IN-WALL INTERVAL TIMERS

A. Manufacturers:
   1. Intermatic, Inc: www.intermatic.com/#sle.
   2. Paragon, a brand of Invensys Controls: www.invensyscontrols.com.
   3. Tork, a division of NSI Industries LLC: www.tork.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.
   5. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. Digital Electronic In-Wall Interval Timers:
   1. Description: Factory-assembled solid state programmable controller with LCD display, suitable for mounting in standard wall box, and listed and labeled as complying with UL 916 or UL 917.
   2. Program Capability: Designed to turn load off at end of preset time interval.
   3. Time Interval: Field selectable range of presets available up to 12 hours.
   4. Provide field selectable audible and visual indication to warn that end of interval operation is about to turn off load.
   5. Provide power outage backup to retain programming and maintain clock.
   6. Manual override: Capable of both turning load off and resetting timer to original preset time interval.
   7. Switch Configuration: Suitable for use in either SPST or 3-way application.
   8. Contact Ratings:
      a. Resistive Load: Not less than 20 A at 120-277 V ac.
      b. Tungsten Load: Not less than 15 A at 120 V ac.
      c. Ballast Load: Not less than 16 A at 120-277 V ac.
      d. Motor Load: Not less than 1 HP at 120 V ac or 2 HP at 240 V ac.

C. Spring Wound In-Wall Interval Timers:
   1. Description: Factory-assembled controller with mechanical spring wound timing mechanism requiring no electricity to operate; suitable for mounting in standard wall box; rotary control operator with matching wall plate factory marked with time interval units; listed and labeled as complying with UL 916 or UL 917.
   2. Program Capability: Designed to turn load off at end of preset time interval.
   3. Time Interval: User selectable from zero up to 15 minutes.
   4. Manual override: Provide hold feature to disable timer for constant on operation.
   5. Switch Configuration: SPST.
   6. Contact Ratings: As required to control the load indicated on drawings.
   7. Contact Ratings:
      a. Resistive Load: Not less than 20 A at 120 V ac or 10 A at 277 V ac.
      b. Inductive Load: Not less than 20 A at 120 V ac or 10 A at 277 V ac.
      c. Tungsten Load: Not less than 7 A at 120 V ac.
      d. Motor Load: Not less than 1 HP at 120 V ac or 2 HP at 250 V ac.

2.05 OUTDOOR PHOTO CONTROLS

A. Manufacturers:
   1. Intermatic, Inc: www.intermatic.com/#sle.
   2. Paragon, a brand of Invensys Controls: www.invensyscontrols.com.
   3. Tork, a division of NSI Industries LLC: www.tork.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Stem-Mounted Outdoor Photo Controls:
   1. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.
   2. Housing: Weatherproof, impact resistant polycarbonate.
   3. Photo Sensor: Cadmium sulfide.
   4. Provide external sliding shield for field adjustment of light level activation.

5. Light Level Activation: 1 to 5 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
6. Voltage: As required to control the load indicated on the drawings.
7. Failure Mode: Fails to the on position.
8. Load Rating: As required to control the load indicated on the drawings.
9. Provide accessory wall-mounting bracket where indicated or as required to complete installation.

2.06 DAYLIGHTING CONTROLS

A. Manufacturers:
1. Hubbell Building Automation, Inc: www.hubbellautomation.com/#sle.
2. Sensor Switch Inc: www.sensorswitch.com/#sle.
3. WattStopper: www.wattstopper.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.
5. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. System Description: Control system consisting of photo sensors and compatible control modules and power packs, contactors, or relays as required for automatic control of load indicated according to available natural light; capable of integrating with occupancy sensors and manual override controls.

C. Daylighting Control Photo Sensors: Low voltage class 2 photo sensor units with output signal proportional to the measured light level and provision for zero or offset based signal.
1. Sensor Type: Filtered silicon photo diode.
2. Sensor Range:
a. Indoor Photo Sensors: 5 to 100 footcandles.
3. Finish: White unless otherwise indicated.
4. Where wired sensors are indicated, wireless sensors are acceptable provided that all components and wiring modifications necessary for proper operation are included.
5. Wireless Daylighting Control Photo Sensors:
a. RF Range: 30 feet through typical construction materials.
b. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of CFR, Title 47, Part 15, for Class B application.
c. Power: Battery-operated with minimum ten-year battery life.

D. Dimming Photo Sensors: Photo sensor units with integral controller compatible with specified dimming ballasts, for direct continuous dimming of up to 50 ballasts.

E. Daylighting Control Switching Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors, for switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.
1. Operation: Unless otherwise indicated, load to be turned on when light level is below selected low set point and load to be turned off when light level is above selected high set point, with a no switching dead band between set points to prevent unwanted cycling.
2. Input Delay: To prevent unwanted cycling due to intermittent light level fluctuations.
3. Control Capability:
a. Multi-Zone Switching Modules: Capable of controlling up to three separately programmable channels.

F. Daylighting Control Switching Modules for Wireless Sensors:
1. Description: Plenum rated, self-contained relay compatible with specified wireless photo sensors for switching of line voltage loads in response to changes in measured light levels according to selected settings.
2. Operation: Unless otherwise indicated, load to be turned on when light level is below selected low set point and load to be turned off when light level is above selected high set point, with a no switching dead band between set points to prevent unwanted cycling.
3. Input Delay: To prevent unwanted cycling due to intermittent light level fluctuations.

4. Control Capability: Capable of controlling one programmable channel.
5. Input Supply Voltage: Dual rated for 120/277 V ac.
6. Load Rating:
    a. General Purpose Load: Not less than 16 A.
    b. Motor Load: Not less than 1/2 HP (120V) and 1.5 HP (277V).

G. Daylighting Control Dimming Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors and with specified dimming ballasts, for both continuous dimming of compatible dimming ballasts and switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.
    1. Operation: Unless otherwise indicated, specified load to be continuously brightened as not enough daylight becomes available and continuously dimmed as enough daylight becomes available.
    2. Load to be turned off when available daylight is sufficient to fully dim the load, after the selected time delay.
    3. Control Capability: Capable of controlling up to three separately programmable channels, with up to 50 ballasts per channel.
    4. Dimming and Fade Rates: Adjustable from 5 to 60 seconds.
    5. Cut-Off Delay: Selectable and adjustable from 0 to 20 minutes.

H. Power Packs for Low Voltage Daylighting Control Modules:
    1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage daylighting control modules for switching of line voltage loads. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
    2. Input Supply Voltage: Dual rated for 120/277 V ac.
    3. Load Ratings: As required to control the load indicated on drawings.

I. Accessories:
    1. Where indicated, provide compatible accessory wall switches for manual override control.
    2. Where indicated, provide compatible accessory wireless controls for manual override control.
        a. Products:
            1) Hubbell Biuilding Automaiton.
            2) Sensor Switch.
            3) Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of lighting control devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switch Occupancy Sensors: 48 inches above finished floor.
      b. In-Wall Time Switches: 48 inches above finished floor.
      c. In-Wall Interval Timers: 48 inches above finished floor.
   2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
   3. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

C. Install lighting control devices in accordance with manufacturer's instructions.

D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

E. Install lighting control devices plumb and level, and held securely in place.

F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 27 26.

G. Provide required supports in accordance with Section 26 05 29.

H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

I. Identify lighting control devices in accordance with Section 26 05 53.

J. Occupancy Sensor Locations:
   1. Location Adjustments: Do not make adjustments to locations without obtaining approval from the Architect.
   2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

K. Outdoor Photo Control Locations:
   1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
   2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.

L. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.

M. Daylighting Control Photo Sensor Locations:
   1. Location Adjustments: Do not make adjustments to locations without obtaining approval from the Architect.
   2. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure the light level controlled at the designated task location, while minimizing the measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.
   3. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into the space, while minimizing the measured amount of lighting from artificial sources.

N. Lamp Burn-In: Operate lamps at full output for minimum of 100 hours or prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

O. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each lighting control device for damage and defects.

C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

D. Test time switches to verify proper operation.

E. Test outdoor photo controls to verify proper operation, including time delays where applicable.

F. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.

G. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

D. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Architect. Record settings in written report to be included with submittals.

E. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect.

F. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Architect.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 COMMISSIONING

A. See Section 01 91 13 for commissioning requirements.

3.08 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.

END OF SECTION 26 09 23

SECTION 26 22 00
LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General purpose transformers.

B. K-factor transformers rated for nonlinear loads.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 34 - Conduit: Flexible conduit connections.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 05 34 - Conduit: Flexible conduit connections.

F. Section 26 24 16 - Panelboards.

1.03 REFERENCE STANDARDS

A. 10 CFR 431, Subpart K - Energy Efficiency Program for Certain Commercial and Industrial Equipment - Distribution Transformers.

B. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type Distribution and Power Transformers.

C. IEEE C57.96 - IEEE Standard Guide for Loading Dry-Type Distribution and Power Transformers.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction.

E. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers.

F. NEMA ST 1 - Specialty Transformers (Except General Purpose Type); National Electrical Manufacturers Association.

G. NEMA ST 20 - Dry-Type Transformers for General Applications.

H. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

I. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

J. NFPA 70 - National Electrical Code.

K. UL 506 - Standard for Specialty Transformers.

L. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors required for mounting of transformers.

B. NEMA TR-1/ANSI 57.12.51 and 57.12.50

C. Federal Register - US department of Energy, Office of Energy Efficiency and Renewable Energy, 10 CFR Part 30, July 29, 2004. Energy Conservation Program for Commercial and Industrial Equipment, Energy Conservaiton Standards for Distribution Transformers, Proposed Rule.

D. ANSI/ASHRAE/IESNA 90.1 - Energy Efficient Design on New Buildings Except Low- Rise Residential Buildings.

1. Transformer selection based on optimizing the combination of no-load, part-load, and full-load losses without compromising operational and reliability requirements for the building.

E. ANSI/NEMA TP-1 - Guide for Determining Energy Efficiency for Distribution Transformers.

1. For Reference only. US DOE deos not consider NEMA TP-1 efficiency levels to reflect low life cycle cost.

F. ANSI/NEMA TP-2 - Standard Test Method for Measuring Energy Consumption of Distribution Transformers.

G. IEEE C57.110-1998 - IEEE Recommended Practice for establishing transformer capability when feeding nonsinusoidal load currents.
   1. Transformers losses increase in proportion to the mix of electronic equipment in the overall load fed from transformer.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.

C. Provide linear load efficiency data at 25 %, 35%, 50 %, 75 % , and 100 % full load.
   1. Vibration Isolators: Include attachment method and rated load and deflection.

D. Shop Drawings: Provide dimensioned plan and elevation views of transformers and adjacent equipment with all required clearances indicated.

E. Product Data: Provide outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, tap configurations, insulation system type, core and coil material and rated temperature rise.

F. Test Reports: Indicate loss data, efficiency at 0, 25, 50, 75 and 100 percent rated load, and sound level.

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Maintenance Data: Include recommended maintenance procedures and intervals.

I. Project Record Documents: Record actual locations of transformers.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

E. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Ambient Temperature: Do not exceed the following maximum temperatures during and after installation of transformers.
   1. Greater than 10 kVA: 104 degrees F maximum.

2. Less than 10 kVA: 77 degrees F maximum.

B. Ambient Temperature: Do not exceed 86 degrees F average or 104 degrees F maximum measured during any 24 hour period during and after installation of transformers.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Schneider Electric; Square D Products; Premium 30 energy efficient: www.schneider-electric.us/#sle.

B. Eaton Electrical/Cutler-Hammer: www.eatonelectrical.com.

C. GE Industrial: www.geindustrial.com.

D. Powersmiths International Corp.

E. Substitutions: See Section 01 60 00 - Product Requirements.

F. Source Limitations: Furnish transformers produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ALL TRANSFORMERS

A. Description: High performance,energy efficient, copper wound transformer with 30 % less loses than NEMA TP_1 . Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
   1. Altitude: Less than 3,300 feet.
   2. Ambient Temperature:
      a. Greater than 10 kVA: Not exceeding 104 degrees F.
      b. Less than 10 kVA: Not exceeding 77 degrees F.
   3. Ambient Temperature: Not exceeding 86 degrees F average or 104 degrees F maximum measured during any 24 hour period.

C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.

D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.

E. Basic Impulse Level: 10 kV.

F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

G. Isolate core and coil from enclosure using vibration-absorbing mounts.

H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.03 GENERAL PURPOSE TRANSFORMERS

A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.

B. Primary Voltage: 480 volts delta, 3 phase.

C. Secondary Voltage: 208Y/120 volts, 3 phase 4 wire.

D. Insulation System and Allowable Average Winding Temperature Rise:

1. 15 kVA and Larger: Class 220 degrees C insulation system with 115 degrees C average winding temperature rise.

E. Coil Conductors: Continuous copper windings with terminations brazed or welded.

F. Winding Taps:
1. Less than 3 kVA: None.
2. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage.
3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
4. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.

G. Energy Efficiency: DOE 2016 energy efficiency levels.

H. Sound Levels: Low sound levels at least 5 db less than NEMA ST 20 standard sound levels.

I. Mounting Provisions:
1. Less than 15 kVA: Suitable for wall mounting.
2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
3. Larger than 75 kVA: Suitable for floor mounting.

J. Transformer Enclosure: Comply with NEMA ST 20.
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor clean, dry locations: Type 2.
2. Construction: Heavy gage steel.
   a. Less than 15 kVA: Totally enclosed, non-ventilated.
   b. 15 kVA and Larger: Ventilated.
3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
4. Provide lifting eyes or brackets.

K. Accessories:
1. Lug Kits: Sized as required for termination of conductors as indicated on the drawings.

L. Primary Voltage: 480 volts, 3 phase.

M. Secondary Voltage: 208Y/120 volts, 3 phase.

N. Insulation system and average winding temperature rise for rated kVA as follows:
1. 1-15 kVA: Class 185 with 115 degrees C rise, in a 40 C ambient setting.
2. 16-500 kVA: Class 220 with 115 degrees C rise, in a 40 C ambient setting.

O. Case Temperature: Do not exceed 35 degrees C rise above ambient at warmest point at full load.

P. Winding Taps:
1. Transformers Less than 15 kVA: Two 5 percent below rated voltage, full capacity taps on primary winding.
2. Transformers 15 kVA and Larger: Two 2-1/2% full capacity taps above and below normal primary voltage.

Q. Sound Levels: NEMA ST 20.

R. Energy Standard
1. Efficiency at 50% load is at least 0.9% higher than NEMA TP-1 for transformers up to 750 KVA.

S. Basic Impulse Level: 10 kV

T. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

U. Mounting:
1. 1-15 kVA: Suitable for wall mounting.
2. 16-75 kVA: Suitable for wall mounting.

3. Larger than 75 kVA: Suitable for floor mounting.

V. Coil Conductors: Continuous copper windings with terminations brazed or welded.

W. Transformer Enclosure: NEMA ST 20.
1. Type 1.
2. Ventilated.
3. Provide lifting eyes or brackets.
4. All terminals, including those for changing taps, must be readily accessible by removing front cover plates.

X. Isolate core and coil from enclosure using vibration-absorbing mounts.

Y. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

2.04 K-FACTOR TRANSFORMERS RATED FOR NONLINEAR LOADS

A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 1561, and designed to supply nonlinear loads to the degree designated by the UL defined K-factor; ratings as indicated on the drawings.

B. Primary Voltage: 480 volts delta, 3 phase.

C. Secondary Voltage: 208Y/120 volts, 3 phase.

D. K-factor Rating: K-4, or higher.

E. Insulation System and Allowable Average Winding Temperature Rise: Class 220 degrees C insulation system with 115 degrees C average winding temperature rise.

F. Coil Conductors: Continuous copper windings with terminations brazed or welded. Individually insulate secondary conductors and arrange to minimize hysteresis and eddy current losses at harmonic frequencies. Size secondary neutral conductor at twice the secondary phase conductor ampacity.

G. Winding Taps: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.

H. Neutral Bus: Sized to accommodate twice the rated secondary current.

I. Energy Efficiency: Comply with DOE 2016 requirements.

J. Sound Levels: Standard sound levels complying with NEMA ST 20.

K. Mounting Provisions:
1. Up to 75 kVA: Suitable for wall, floor, or trapeze mounting.
2. Larger than 75 kVA: Suitable for floor mounting.

L. Electrostatic Shield: Provide grounded copper electrostatic shield between primary and secondary windings to attenuate electrical noise.

M. Transformer Enclosure: Comply with NEMA ST 20.
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
a. Indoor clean, dry locations: Type 2.
2. Construction: Steel, ventilated.
3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
4. Provide lifting eyes or brackets.

N. Accessories:
1. Mounting Brackets: Provide manufacturer's standard brackets.
2. Lug Kits: Sized as required for termination of conductors as indicated on the drawings.

2.05 SOURCE QUALITY CONTROL

A. Factory test transformers according to NEMA ST 20.

B. Production test each unit according to NEMA ST 20.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.

C. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1.

B. Install transformers in accordance with manufacturer's instructions.

C. Install transformers in accordance with NECA 409 and IEEE C57.94.

D. Use flexible conduit, under the provisions of Section 26 05 34, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.

F. Set transformers plumb and level.

G. Use flexible conduit, under the provisions of Section 26 05 34, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

H. Mount wall-mounted transformers using integral flanges or accessory brackets furnished by the manufacturer.

I. Mount floor-mounted transformers on properly sized 4 inch high concrete pad constructed in accordance with Section 03 30 00.

J. Mount floor-mounted transformers using vibration isolators suitable for isolating the transformer noise from the building structure.

K. Mount floor-mounted transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.

L. Mount trapeze-mounted transformers as indicated.

M. Provide seismic restraints.

N. Provide grounding and bonding in accordance with Section 26 05 26.

O. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.

P. Where not factory-installed, install lugs sized as required for termination of conductors as shown on the drawings.

Q. Identify transformers in accordance with Section 26 05 53.

R. Install transformer identification nameplate in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Perform field inspection, testing, and adjusting in accordance with Section 01 40 00.

C. Inspect and test in accordance with NETA STD ATS, except Section 4.

D. Perform inspections and tests listed in NETA STD ATS, Section 7.2.1.1. In addition to the basic requirements of Section 7.2, include the following:
   1. Perform turns ratio tests at all tap positions.
   2. Verification that as-left tap connections are as specified.
   3. Perform excitation-current tests on each phase.

4. Measure the resistance of each winding at each tap connection.
5. Overpotential test on all high- and low-voltage windings-to-ground.

3.04 ADJUSTING

A. Measure primary and secondary voltages and make appropriate tap adjustments.

B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from transformer components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 22 00

SECTION 26 24 13
SWITCHBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Switchboards.

B. Overcurrent protective devices for switchboards.

C. Switchboard accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete for supporting foundations and pads.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 29 - Hangers and Supports for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 05 73 - Overcurrent Protective Device Coordination Study: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

F. Section 26 27 01 - Electrical Service Entrance.

G. Section 26 28 13 - Fuses.

H. Section 26 43 00 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service.

B. ANSI C12.1 - American National Standard Code for Electricity Metering.

C. ANSI C39.1 - American National Standard Requirements for Electrical Analog Indicating Instruments; 1981 (R1992).

D. IEC 60051-1 - Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories - Part 1: Definitions and General Requirements Common To All Parts;.

E. IEC 60051-2 - Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories - Part 2: Special Requirements for Ammeters and Voltmeters.

F. IEEE C12.1 - American National Standard Code for Electricity Metering; Institute of Electrical and Electronic Engineers; 1988.

G. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers.

H. NECA 1 - Standard for Good Workmanship in Electrical Construction.

I. NECA 400 - Standard for Installing and Maintaining Switchboards.

J. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

K. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum).

L. NEMA PB 2 - Deadfront Distribution Switchboards.

M. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less.

N. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

O. NFPA 70 - National Electrical Code.

P. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.

Q. UL 891 - Switchboards.

R. UL 1053 - Ground-Fault Sensing and Relaying Equipment.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   4. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Service Entrance Switchboards:
   1. Coordinate with Utility Company to provide switchboards with suitable provisions for electrical service and utility metering, where applicable.
   2. Coordinate with North Providence School Department to arrange for Utility Company required access to equipment for installation and maintenance.
   3. Obtain Utility Company approval of switchboard prior to fabrication.
   4. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, enclosures, overcurrent protective devices, and other installed components and accessories.
   1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.

C. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of switchboards and adjacent equipment with all required clearances indicated.
   2. Include wiring diagrams showing all factory and field connections.
   3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
   4. Include documentation of listed series ratings.
   5. Include documentation demonstrating selective coordination.

D. Service Entrance Switchboards: Include documentation of Utility Company approval of switchboard.

E. Product Data: Provide electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of all equipment and components.

F. Shop Drawings: Indicate front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground; and switchboard instrument details.

G. Test Reports: Indicate results of factory production tests.

H. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

I. Project Record Documents: Record actual locations of switchboards.

J. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

K. Maintenance Materials: Furnish the following for North Providence School Department's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Enclosure Keys: Two of each different key.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store switchboards in accordance with manufacturer's instructions, NECA 400, and NEMA PB 2.1.

B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.

C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

D. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

E. Deliver in 48 inch maximum width shipping splits, individually wrapped for protection and mounted on shipping skids.

F. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

G. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Switchboards - Basis of Design: Schneider Electric co. QED power style switchboard.

B. Switchboards - Other Acceptable Manufacturers:
   1. Eaton Corporation: www.eaton.com.
   2. General Electric Company: www.geindustrial.com/#sle.

C. Substitutions: See Section 01 60 00 - Product Requirements.

D. Siemens Industry, Inc: www.usa.siemens.com.

E. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.

F. Schneider Electric; Square D Products: www.schneider-electric.us.

G. Substitutions: See Section 01 60 00 - Product Requirements.

H. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Owners Project Manager accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

I. Source Limitations: Furnish switchboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 SWITCHBOARDS

A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.

D. Front-Connected Switchboards:
   1. Main Device(s): Individually-mounted.
   2. Feeder Devices: Panel/group-mounted.
   3. Arrangement: Front accessible only (not rear accessible), rear aligned.
   4. Gutter Access: Bolted covers.
   5. Basis of Design: Schneider Electric QED power style switchboard.

E. Service Conditions:
   1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:
      a. Altitude: Less than 6,600 feet.
      b. Ambient Temperature:
         1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23 degrees F and 104 degrees F.
   2. Provide switchboards and associated components suitable for operation at indicated ratings under the service conditions at the installed location.
      a. Altitude: 1000 feet.
      b. Ambient Temperature: Between 23 degrees F and 104 degrees F.

F. Short Circuit Current Rating:
   1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
   2. Minimum Rating: 65,000 rms symmetrical amperes.
   3. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70.
   4. Label equipment utilizing series ratings as required by NFPA 70.

G. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

H. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.

I. Bussing: Sized in accordance with UL 891 temperature rise requirements.
   1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
   2. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
   3. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
   4. Phase and Neutral Bus Material: Copper.
   5. Ground Bus Material: Copper.

J. Conductor Terminations: Suitable for use with the conductors to be installed.
   1. Line Conductor Terminations:

a. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
b. Main and Neutral Lug Type: Mechanical.

2. Load Conductor Terminations:
   a. Lug Material: Copper, suitable for terminating copper conductors only.
   b. Lug Type:
      1) Provide mechanical lugs unless otherwise indicated.
      2) Provide compression lugs where indicated.

K. Enclosures:
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1 or Type 2 (drip-proof).
2. Finish: Manufacturer's standard unless otherwise indicated.

L. Future Provisions:
1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
2. Arrange and equip through bus and ground bus to accommodate future installation of additional switchboard sections.

M. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 43 00, list switchboards as a complete assembly including surge protective device.

N. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
1. Where overcurrent protective devices equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
   a. Use zero sequence or residual ground fault detection method unless otherwise indicated.
   b. Provide test panel and field-adjustable ground fault pick-up and delay settings.

O. Arc Flash Energy-Reducing Maintenance Switching: For circuit breakers rated 1200 A or higher, provide a local accessory switch with status indicator light that permits selection of a maintenance mode with alternate electronic trip unit settings for reduced fault clearing time.

P. North Providence School Department Metering:
1. Provide microprocessor-based digital electrical metering system including all instrument transformers, wiring, and connections necessary for measurements specified.
2. Basis of Design: ION 7350.
3. Measured Parameters:
   a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
   b. Current (Amps): For each phase and neutral.
   c. Frequency (Hz).
   d. Real power (kW): For each phase, 3-phase total.
   e. Reactive power (kVAR): For each phase, 3-phase total.
   f. Apparent power (kVA): For each phase, 3-phase total.
   g. Power factor.
   h. Current demand.
   i. Power demand: Real, reactive, and apparent.
4. Meter Accuracy: Plus/minus 1.0 percent.
5. Features:
   a. Communications Capability: Compatible with system indicated. Provide all accessories necessary for proper interface.
   b. Remote monitoring capability via PC.

Q. Instrument Transformers:
   1. Comply with IEEE C57.13.
   2. Select suitable ratio, burden, and accuracy as required for connected devices.
   3. Current Transformers: Connect secondaries to shorting terminal blocks.
   4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

R. Description: NEMA PB 2 switchboard with electrical ratings and configurations as indicated and specified.

S. Ratings:
   1. Voltage: 120/208; 277/480 volts.
   2. Configuration: Three phase, four wire, grounded.
   3. Main Bus: 2000 amps.277/480 v, 2000 amps, 208/120v .
   4. Integrated Equipment Rating: 100000 rms amperes symmetrical.

T. Main Section Devices: Individually mounted and compartmented.

U. Distribution Section Devices: _Group mounted- double row sections.

V. Bus Material: Copper with tin plating, standard size.

W. Bus Connections: Bolted, accessible from front for maintenance.

X. Fully insulate load side bus bars

Y. Ground Bus: Extend length of switchboard.

Z. Insulated Ground Bus: Extend length of switchboard.

AA. Molded Case Circuit Breakers: Integral thermal and instantaneous magnetic trip in each pole.
   1. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
   2. Include shunt trip where indicated.
   3. Circuit Breakers 1- 400amp and up shall be provided with field repalceable trip unit.
   4. All Feeder breakers in 208/120v swithboard shall be series rated for min. of 65 kAIC with 1-pole circuit breakers in all panelboards.All feeder breakers in 480y/277v ,3ph4w switchboard shall be series rated for min. of 65 KAIC.

AB. Solid-State Molded Case Circuit Breakers: With electronic sensing, timing and tripping circuits for adjustable current settings; UL listed.
   1. Ground fault trip, ground fault sensing integral with circuit breaker.
   2. Instantaneous trip.
   3. Adjustable short time/ long time trip.
   4. Stationary mounting.
   5. Include shunt trip where indicated.

AC. Line and Load Terminations: Accessible from the front only of the switchboard, suitable for the conductor materials and sizes indicated.

AD. Ground Fault Sensor: Zero sequence type.

AE. Ground Fault Relay: Adjustable ground fault sensitivity from 200 to 1200 amperes, time delay adjustable from 0 to 15 seconds. Provide monitor panel with lamp to indicate relay operation, TEST and RESET control switches.Max time delay shall be one second for ground fault currents equal to or greater ethan 3000 amps.

AF. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Provide continuous current rating as indicated.

AG. Enclosure: Type _NEMA 1-Indoors.
   1. Align sections at front and rear.
   2. Switchboard Height: 91.5 inches, excluding floor sills, lifting members and pull boxes.
   3. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.

4. Structure: Free standing, self supporting, totally front accessible.

2.03 OVERCURRENT PROTECTIVE DEVICES

A. Circuit Breakers:
   1. Interrupting Capacity:
      a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
      b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
      c. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.
   2. Molded Case Circuit Breakers:
      a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
         1) Provide thermal magnetic circuit breakers unless otherwise indicated.
         2) Provide electronic trip circuit breakers where indicated.
      b. Minimum Interrupting Capacity:
         1) 14000 rms symmetrical amperes at 240 VAC or 208 VAC.
         2) 21000 rms symmetrical amperes at 480 VAC.
      c. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
         1) Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
      d. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
         1) Provide the following field-adjustable trip response settings:
            (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
            (b) Long time delay.
            (c) Short time pickup and delay.
            (d) Instantaneous pickup.
            (e) Ground fault pickup and delay where ground fault protection is indicated.
      e. Provide the following features and accessories where indicated or where required to complete installation:
         1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.

2.04 SURGE PROTECTIVE DEVICES

A. See Section 26 43 00 for factory-installed, internally mounted surge protective devices. List and label switchboards containing surge protective devices as a complete assembly including surge protective device.

2.05 POWER METERS

A. Manufacturers:
   1. SQ D ION 7350 or approved equal.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Watt-Hour Meters and Wattmeters: ANSI C12.1, three phase induction type with two stators, each with current and potential coil, rated 5 amperes and 120 volts at 60 Hertz.
   1. Meter suitable for connection to 3- and 4-wire circuits.
   2. Potential indicating lamps.
   3. Adjustments for light and full load, phase balance, and power factor.

4. Digital register.
5. Integral demand indicator.
6. Ratchets to prevent reverse rotation.
7. Removable meter with draw-out test plug.
8. Semi-flush mounted case with matching cover.
9. BACnet gateway to provide connection to building automation system.

C. Provide meters with appropriate multiplier tags.

2.06 METERING TRANSFORMERS

A. Manufacturers:
1. Square D or equal.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Current Transformers: IEEE C57.13, 5 ampere secondary, wound; bushing; bar or window type, with single secondary winding and secondary shorting device, primary/secondary ratio as required, burden and accuracy consistent with connected metering and relay devices, 60 Hertz.

C. Potential Transformers: IEEE C57.13, 120 volt single secondary, disconnecting type with integral fuse mountings, primary/secondary ratio as required, burden and accuracy consistent with connected metering and relay devices, 60 Hertz.

2.07 SOURCE QUALITY CONTROL

A. Factory test switchboards according to NEMA PB 2, including the following production (routine) tests on each switchboard assembly or component:
1. Dielectric tests.
2. Mechanical operation tests.
3. Grounding of instrument transformer cases test.
4. Electrical operation and control wiring tests, including polarity and sequence tests.
5. Ground-fault sensing equipment test.

B. Shop inspect and test switchboard according to NEMA PB 2.

C. Make completed switchboard available for inspection at manufacturer's factory prior to packaging for shipment. Notify North Providence School Department at least 7 days before inspection is allowed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that the ratings and configurations of the switchboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive switchboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide concrete housekeeping pad under the provisions of Section 03 30 00.

B. Verify that field measurements are as instructed by manufacturer.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.

C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.

D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch between switchboard and wall.

E. Provide required support and attachment components in accordance with Section 26 05 29.

F. Install switchboards plumb and level.

G. Unless otherwise indicated, mount switchboards on properly sized 4 inch high concrete pad constructed in accordance with Section 03 30 00.

H. Provide grounding and bonding in accordance with Section 26 05 26.

I. Install all field-installed devices, components, and accessories.

J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

K. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed in accordance with Section 26 05 73.

L. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

M. Provide filler plates to cover unused spaces in switchboards.

N. Identify switchboards in accordance with Section 26 05 53.

O. Install switchboard in locations shown on drawings, according to NEMA PB 2.1.

P. Install in a neat and workmanlike manner, as specified in NECA 400.

Q. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

R. Identify switchboards in accordance with Section 26 05 53.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

C. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.

D. Perform field inspection and testing in accordance with Section 01 40 00.

E. Inspect and test in accordance with NETA STD ATS, except Section 4.

F. Perform inspections and tests listed in NETA STD ATS, Section 7.1.

G. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 225 amperes. Tests listed as optional are not required.

H. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
   1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.

I. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.

J. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10.

K. Test shunt trips to verify proper operation.

L. Correct deficiencies and replace damaged or defective switchboards or associated components.

3.05 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of switchboard covers and doors.

C. Adjust all operating mechanisms for free mechanical movement.

D. Tighten bolted bus connections in accordance with manufacturer's instructions.

E. Adjust circuit breaker trip and time delay settings to values indicated.

F. Adjust circuit breaker trip and time delay settings to values as instructed by Architect.

3.06 CLEANING

A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

B. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.

C. Touch up scratched or marred surfaces to match original finish.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

3.08 PROTECTION

A. Protect installed switchboards from subsequent construction operations.

END OF SECTION 26 24 13

SECTION 26 24 16
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

D. Section 26 05 29 - Hangers and Supports for Electrical Systems.

E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 05 73 - Overcurrent Protective Device Coordination Study: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

G. Section 26 22 00 - Low-Voltage Transformers: Small power centers with integral primary breaker, transformer, and panelboard.

H. Section 26 28 13 - Fuses: Fuses for fusible switches and spare fuse cabinets.

I. Section 26 43 00 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction.

C. NECA 407 - Standard for Installing and Maintaining Panelboards.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.

F. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum).

G. NEMA PB 1 - Panelboards.

H. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

I. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

J. NFPA 70 - National Electrical Code.

K. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations.

L. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations.

M. UL 67 - Panelboards.

N. UL 98 - Enclosed and Dead-Front Switches.

O. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.

P. UL 869A - Reference Standard for Service Equipment.

Q. UL 943 - Ground-Fault Circuit-Interrupters.

R. UL 1053 - Ground-Fault Sensing and Relaying Equipment.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
   4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
   1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.

C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include wiring diagrams showing all factory and field connections.
   2. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

G. Maintenance Materials: Furnish the following for North Providence School Department's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Panelboard Keys: Two of each different key.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:
   1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

1.09 MAINTENANCE MATERIALS

A. See Section 01 60 00 - Product Requirements, for additional provisions.

B. Furnish two of each panelboard key.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation; Cutler-Hammer Products: www.eaton.com/#sle.

B. General Electric Company: www.geindustrial.com/#sle.

C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

D. Substitutions: See Section 01 60 00 - Product Requirements.

E. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ALL PANELBOARDS

A. Provide products listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose indicated.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature:
      a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

C. Short Circuit Current Rating:
   1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
   2. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70.
   3. Label equipment utilizing series ratings as required by NFPA 70.

D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

G. Bussing: Sized in accordance with UL 67 temperature rise requirements.
   1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
   2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
   3. Provide separate isolated/insulated ground bus where indicated or where isolated grounding conductors are provided.

H. Conductor Terminations: Suitable for use with the conductors to be installed.

I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    a. Indoor Clean, Dry Locations: Type 1.
2. Boxes: Galvanized steel unless otherwise indicated.
    a. Provide wiring gutters sized to accommodate the conductors to be installed.
3. Fronts:
    a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
    b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
    c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
4. Lockable Doors: All locks keyed alike unless otherwise indicated.
5. Metal frame for type written directory
6.

J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

K. Panelboard Contactors: Where panelboard contactors are indicated, provide electrically operated, mechanically held magnetic contactor complying with NEMA ICS 2.
1. Ampere Rating: Not less than ampere rating of panelboard bus.
2. Short Circuit Current Rating: Not less than the panelboard short circuit current rating.
3. Coil Voltage: As required for connection to control system indicated.

L. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.

M. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

2.03 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Products:
1. SQ D .
2. General Electric.
3. Eaton Cutler Hammer.
4. Substitutions: See Section 01 60 00 - Product Requirements.

C. Conductor Terminations:
1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
2. Main and Neutral Lug Type: Mechanical.

D. Bussing:
1. Phase and Neutral Bus Material: Copper.
2. Ground Bus Material: Copper.

E. Circuit Breakers:
1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.
2. Provide thermal magnetic circuit breakers unless otherwise indicated.
3. Provide electronic trip circuit breakers where indicated.

F. Enclosures:
1. Provide surface-mounted enclosures unless otherwise indicated.
2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable continous hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.

3. Provide metal circuit directory holder mounted on inside of door.

G. Manufacturers:
   1. SQ.D or Equal.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

H. Description: NEMA PB 1, circuit breaker type.

I. Service Conditions:
   1. Altitude: 1000 feet.
   2. Temperature: 55 degrees F.

J. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard.

K. Minimum integrated short circuit rating: As indicated.
   1. 240 Volt Panelboards: 14,000 amperes rms symmetrical (minimum).
   2. 480 Volt Panelboards: 21,000 amperes rms symmetrical (minimum).

L. Molded Case Circuit Breakers: With integral thermal and instantaneous magnetic trip in each pole; UL listed. For air conditioning equipment branch circuits provide circuit breakers UL listed as Type HACR.

M. Molded Case Circuit Breakers with Current Limiters: With replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole; UL listed.

N. Circuit Breaker Accessories: Trip units and auxiliary switches as indicated.

O. Enclosure: NEMA PB 1, Type 1, 5 34" deep, 20" wide, cabinet box. With continued hinge and lock.

P. Cabinet Front: Surface type, fastened with , hinged door with flush lock, finished in manufacturer's standard gray enamel.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Products:
   1. SQD.
   2. General Electric.
   3. Eaton Cutler Hammer.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

C. Conductor Terminations:
   1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
   2. Main and Neutral Lug Type: Mechanical.

D. Bussing:
   1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
   2. Phase and Neutral Bus Material: Copper.
   3. Ground Bus Material: Copper.

E. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

F. Enclosures:
   1. Provide surface-mounted or flush-mounted enclosures as indicated.
   2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable continous hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   3. Provide metal circuit directory holder mounted on inside of door.

G. Manufacturers:
   1. SQ.D or Equal.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

H. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.

I. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard; provide insulated ground bus where scheduled.

J. Minimum Integrated Short Circuit Rating: As indicated.
   1. 240 Volt Panelboards: 14,000 amperes rms symmetrical (minimum).
   2. 480 Volt Panelboards: 21,000 amperes rms symmetrical (minimum).

K. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for all poles; UL listed.
   1. Type SWD for lighting circuits.
   2. Type HACR for air conditioning equipment circuits.
   3. Class A ground fault interrupter circuit breakers where scheduled.
   4. Do not use tandem circuit breakers, or miniature circuit breakers.

L. Enclosure: NEMA PB 1, Type 1.

M. Cabinet Box: 6 inches deep, 20 inches wide for 240 volt and less panelboards, 20 inches wide for 480 volt panelboards.

N. Cabinet Front: Flush or Surface cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

2.05 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
   1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
   2. Interrupting Capacity:
      a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
         1) 14000 rms symmetrical amperes at 240 VAC or 208 VAC.
         2) 21000 rms symmetrical amperes at 480 VAC.
      b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
      c. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.
   3. Conductor Terminations:
      a. Provide mechanical lugs unless otherwise indicated.
      b. Lug Material: Copper, suitable for terminating copper conductors only.
   4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
      a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
      b. Provide interchangeable trip units where indicated.
   5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
      a. Provide the following field-adjustable trip response settings:
         1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
         2) Long time delay.
         3) Short time pickup and delay.
         4) Instantaneous pickup.
         5) Ground fault pickup and delay where ground fault protection is indicated.
   6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

7. Provide the following circuit breaker types where indicated:
    a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
8. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting.
9. Provide listed high intensity discharge lighting rated circuit breakers with HID marking for all branch circuits serving HID lighting.
10. Do not use tandem circuit breakers.
11. Do not use handle ties in lieu of multi-pole circuit breakers.

2.06 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install panelboards securely, in a neat and workmanlike manner in accordance with NECA 1 (general workmanship), NECA 407 (panelboards), and NEMA PB 1.1.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required supports in accordance with Section 26 05 29.

E. Install panelboards plumb.

F. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

G. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

H. Mount floor-mounted power distribution panelboards on properly sized 4 inch high concrete pad constructed in accordance with Section 03 30 00.

I. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

J. Provide grounding and bonding in accordance with Section 26 05 26.
    1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
    2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.

K. Install all field-installed branch devices, components, and accessories.

L. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 05 73.

M. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

N. Install panelboards in accordance with NEMA PB 1.1 and NECA 1.

O. Install panelboards plumb. Install recessed panelboards flush with wall finishes, where installed surface mounted secure or anchor panelboard to brick or cinder block wall.

P. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.

Q. Provide filler plates to cover unused spaces in panelboards.

R. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
   1. Emergency and night lighting circuits.
   2. Fire detection and alarm circuits.
   3. Communications equipment circuits.
   4. Intrusion detection and access control system circuits.
   5. Video surveillance system circuits.

S. Identify panelboards in accordance with Section 26 05 53.

T. Provide computer-generated circuit directory for each lighting and appliance panelboard and each power distribution panelboard provided with a door, clearly and specifically indicating the loads served. Identify spares and spaces.

U. Provide identification nameplate for each panelboard in accordance with Section 26 05 53.

V. Provide arc flash warning labels in accordance with NFPA 70.

W. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Identify each as SPARE.
   1. Minimum spare conduits: 5 empty 1 inch.

X. Ground and bond panelboard enclosure according to Section 26 05 26.

3.03 FIELD QUALITY CONTROL

A. Perform inspection, testing, and adjusting in accordance with Section 01 40 00.

B. Perform field inspection and testing in accordance with Section 01 40 00.

C. Inspect and test in accordance with NETA STD ATS, except Section 4.

D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

E. Test GFCI circuit breakers to verify proper operation.

F. Test shunt trips to verify proper operation.

G. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

H. Correct deficiencies and replace damaged or defective panelboards or associated components.

I. Perform inspections and tests listed in NETA STD ATS, Section 7.5 for switches, Section 7.6 for circuit breakers.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.05 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 24 16

SECTION 26 27 01
ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Service racks.

B. Metering transformer cabinets.

C. Meter bases.

1.02 RELATED REQUIREMENTS

A. Section 26 24 13 - Switchboards: Metering transformer compartment.

B. Section 26 09 14 - Electrical Power Monitoring: Electric meters.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association.

B. NFPA 70 - National Electrical Code; National Fire Protection Association.

1.04 SYSTEM DESCRIPTION

A. System Characteristics: 480Y/277 volts, three phase, four-wire, 60 Hertz.

B. Service Entrance:

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section. Review service entrance requirements and details with Utility Company representative.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide ratings and dimensions of transformer cabinets and meter bases.

C. Submit utility company-prepared drawings.

1.07 QUALITY ASSURANCE

A. Utility Company: City of Seaford dept of Electric

B. Perform work in accordance with utility company written requirements and NFPA 70.
   1. Maintain one copy of each document on site.

C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.08 PRE-INSTALLATION MEETING

A. Convene one week prior to commencing work of this section. Review service entrance requirements and details with Utility Company representative.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. GE Industrial: www.geindustrial.com.

B. Milbank Manufacturing: www.milbankmfg.com.

C. Square D: www.squared.com.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 COMPONENTS

A. Metering Transformer Cabinets: Sheet metal cabinet with hinged door, conforming to utility company requirements, with provisions for locking and sealing.
   1. Size: As required by utility.

B. Meter Base: Furnished by utility company.

C. Utility Transformer Pad: sized as indicated on drawings or size as required by Delmarva Power.

D. Other Components: As required by utility company.

PART 3 EXECUTION

3.01 PREPARATION

A. Arrange with utility company to obtain permanent electric service to the Project.

B. Verify that field measurements are as indicated on utility company drawings.

3.02 INSTALLATION

A. Install service rack, transformer pad, metering transformer cabinets, and meter base as required by utility company.

B. Install securely, in a neat and workmanlike manner, as specified in NECA 1.

END OF SECTION 26 27 01

SECTION 26 27 17
EQUIPMENT WIRING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

A. Section 26 05 34 - Conduit.

B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables (600 V and Less).

C. Section 26 05 37 - Boxes.

D. Section 26 27 26 - Wiring Devices.

1.03 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices.

B. NEMA WD 6 - Wiring Devices - Dimensional Specifications.

C. NFPA 70 - National Electrical Code.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 COORDINATION

A. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

B. Determine connection locations and requirements.

C. Sequence rough-in of electrical connections to coordinate with installation of equipment.

D. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
   1. Colors: Conform to NEMA WD 1.
   2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
   3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
   4. Product:
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Disconnect Switches: As specified in Section and in individual equipment sections.

C. Wiring Devices: As specified in Section 26 27 26.

D. Flexible Conduit: As specified in Section 26 05 34.

E. Wire and Cable: As specified in Section 26 05 19.

F. Boxes: As specified in Section 26 05 37.

2.02 EQUIPMENT CONNECTIONS

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

J. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

END OF SECTION 26 27 17

SECTION 26 27 26
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Receptacles.

D. Wall plates.

E. Floor box service fittings.

1.02 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 33.23 - Surface Raceways: Surface raceway systems, including multioutlet assemblies.

D. Section 26 05 37 - Boxes.

E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 09 23 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors, in-wall time switches, and in-wall interval timers.

G. Section 26 27 17 - Equipment Wiring: Cords and plugs for equipment.

H. Section 26 29 13 - Enclosed Controllers: Manual motor starters and horsepower rated motor-starting switches without overload protection.

I. Section 27 10 05 - Structured Cabling for Voice and Data - Inside-Plant: Voice and data jacks.

1.03 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for.

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification).

C. NECA 1 - Standard for Good Workmanship in Electrical Construction.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices.

E. NEMA WD 1 - General Color Requirements for Wiring Devices.

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications.

G. NFPA 70 - National Electrical Code.

H. UL 20 - General-Use Snap Switches.

I. UL 498 - Attachment Plugs and Receptacles.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices.

K. UL 943 - Ground-Fault Circuit-Interrupters.

L. UL 1472 - Solid-State Dimming Controls.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.

3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
6. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:
1. Do not install wiring devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Operation and Maintenance Data:
1. GFCI Receptacles: Include information on status indicators.

E. Project Record Documents: Record actual installed locations of wiring devices.

F. Maintenance Materials: Furnish the following for North Providence School Department's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Extra Wall Plates: One of each style, size, and finish.
3. Extra Flush Floor Service Fittings: Two of each type.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Products: Listed, classified, and labeled as suitable for the purpose intended.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

1.08 EXTRA MATERIALS

A. See Section 01 60 00 - Product Requirements, for additional provisions.

B. Furnish two of each style, size, and finish wall plate.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hubbell Incorporated; : www.hubbell-wiring.com.

B. Leviton Manufacturing Company, Inc; : www.leviton.com.

C. Lutron Electronics Company, Inc: www.lutron.com.

D. Pass & Seymour, a brand of Legrand North America, Inc; : www.legrand.us

E. Cooper Wiring Devices: www.cooperwiringdevices.com.

F. Leviton Manufacturing, Inc: www.leviton.com.

G. Substitutions: See Section 01 60 00 - Product Requirements.

H. Source Limitations: Where possible, for each type of wiring device furnish products produced by a single manufacturer and obtained from a single supplier.

2.02 APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFI receptacles with specified weatherproof covers for all receptacles installed outdoors or in damp or wet locations.

D. Provide tamper resistant receptacles for receptacles installed in the following areas specified:
   1. Dwelling units.
   2. Guest rooms and guest suites of hotels and motels.
   3. Child care facilities.
   4. Preschools and elementary education facilities.
   5. Business offices, corridors, waiting rooms and the like in clinics, medical and dental offices and outpatient facilities.
   6. Subset of assembly occupancies including places of waiting transportation, gymnasiums, skating rinks, and auditoriums.
   7. Dormitories.

E. Provide GFI protection for all receptacles installed within 6 feet of sinks.

F. Provide GFCI protection for receptacles serving electric drinking fountains.

G. Unless noted otherwise, do not use combination switch/receptacle devices.

H. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

2.03 ALL WIRING DEVICES

A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.04 WALL SWITCHES

A. Manufacturers:
   1. Hubbell Incorporated; : www.hubbell-wiring.com.
   2. Leviton Manufacturing Company, Inc; : www.leviton.com/#sle.
   3. Pass & Seymour, a brand of Legrand North America, Inc; : www.legrand.us/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. All Wall Switches: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

C. Standard Wall Switches: Commercial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

D. Wall Switches: Heavy Duty, AC only general-use snap switch, complying with NEMA WD 6 and WD 1.
   1. Body and Handle: White plastic with toggle handle.
   2. Ratings:
      a. Voltage: 120 - 277 volts, AC.
      b. Current: 20 amperes.
   3. Ratings: Match branch circuit and load characteristics.

E. Switch Types: Single pole, double pole, 3-way, and 4-way.

2.05 WALL DIMMERS

A. Manufacturers:
   1. Leviton Manufacturing Company, Inc; _____: www.leviton.com/#sle.
   2. Lutron Electronics Company, Inc; Maestro Series: www.lutron.com.
   3. Pass & Seymour, a brand of Legrand North America, Inc; _____: www.legrand.us/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. All Wall Dimmers: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

C. Control: Slide control type with separate on/off switch.

2.06 RECEPTACLES

A. Manufacturers:
   1. Hubbell Incorporated; : www.hubbell-wiring.com.
   2. Leviton Manufacturing Company, Inc; : www.leviton.com/#sle.
   3. Pass & Seymour, a brand of Legrand North America, Inc; : www.legrand.us/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. All Receptacles: Self-grounding, tamper resistant, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:
   1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, tamper resistant; single or duplex as indicated on the drawings.
      a. Products:
         1) Hubbell Wiring Devices.
         2) Leviton.
         3) Pass & Saymore.
         4) Substitutions: See Section 01 60 00 - Product Requirements.

D. GFI Receptacles:
   1. All GFI Receptacles: Provide with feed-through protection, light to indicate ground fault tripped condition and loss of protection, and list as complying with UL 943, class A.
   2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, tamper resistant, rectangular decorator style.

E. Receptacles: Heavy duty, complying with NEMA WD 6 and WD 1.
   1. Device Body: White plastic.
   2. Configuration: NEMA WD 6, type as specified and indicated.

F. Convenience Receptacles: Type 5 - 20.

G. Single Convenience Receptacles.

H. Duplex Convenience Receptacles.

I. GFCI Receptacles: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

2.07 TELEPHONE JACKS

A. Product: AMP manufacturing

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.08 WALL PLATES

A. Manufacturers:
   1. Hubbell Incorporated; : www.hubbell-wiring.com/#sle.
   2. Leviton Manufacturing Company, Inc; : www.leviton.com/#sle.
   3. Pass & Seymour, a brand of Legrand North America, Inc; : www.legrand.us/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. All Wall Plates: Comply with UL 514D.
   1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
   2. Size: Standard; .
   3. Screws: Metal with slotted heads finished to match wall plate finish.

C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

D. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

E. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

F. Decorative Cover Plates: stainless steel.

G. Jumbo Cover Plates: stainless steel.

H. Weatherproof Cover Plates: Gasketed cast metal with hinged cover.

2.09 FLOOR BOX SERVICE FITTINGS

A. Manufacturers:
   1. Hubbell Incorporated; : www.hubbell-wiring.com.
   2. Thomas & Betts Corporation; : www.tnb.com/#sle.
   3. Wiremold, a brand of Legrand North America, Inc; : www.legrand.us/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: Service fittings compatible with floor boxes provided under Section 26 05 37 with all components, adapters, and trims required for complete installation.

C. Flush Floor Service Fittings:
   1. Dual Service Flush Combination Outlets:
      a. Cover: Rectangular.
      b. Configuration:
         1) Power: One standard convenience duplex receptacle(s) with duplex flap opening(s).
         2) Communications: Two Data Drops.
         3) Voice and Data Jacks: As specified in Section 27 10 05.
   2. Accessories:
      a. Carpet Flanges: Finish to match covers; configuration as required to accommodate specified covers.

2.10 POKE-THROUGH ASSEMBLIES

A. Description: Assembly comprising floor service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination; fire rating listed to match fire rating of floor and suitable for floor thickness where installed.

B. Flush Floor Service Fittings:
   1. Dual Service Flush Combination Outlets:
      a. Cover: Hinged door(s).
      b. Configuration:
         1) Power: One standard convenience duplex receptacle(s).
         2) Communications: Two data drops..

3) Voice and Data Jacks: As specified in Section 27 10 05.

2. Accessories:
   a. Closure Plugs: Size and fire rating as required to seal unused core hole and maintain fire rating of floor.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that floor boxes are adjusted properly.

F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

G. Verify that openings in access floor are in proper locations.

H. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Perform work in a neat and workmanlike manner in accordance with NECA 1, including mounting heights specified in that standard unless otherwise indicated.

C. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of wiring devices provided under this section.
   1. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
   2. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

D. Install wiring devices in accordance with manufacturer's instructions.

E. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

F. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

G. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

H. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

I. For isolated ground receptacles, connect wiring device grounding terminal only to identified branch circuit isolated equipment grounding conductor. Do not connect grounding terminal to outlet box or normal branch circuit equipment grounding conductor.

J. Unless otherwise indicated, GFCI receptacles may be connected to provide feed-through protection to downstream devices. Label such devices to indicate they are protected by upstream GFCI protection.

K. Install securely, in a neat and workmanlike manner, as specified in NECA 1.

L. Install wiring devices plumb and level with mounting yoke held rigidly in place.

M. Install wall switches with OFF position down.

N. Do not share neutral conductor on branch circuits utilizing wall dimmers.

O. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

P. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

Q. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

R. Install poke-through closure plugs in each unused core holes to maintain fire rating of floor.

S. Install receptacles with grounding pole on top.

T. Connect wiring device grounding terminal to outlet box with bonding jumper.

U. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

V. Connect wiring devices by wrapping conductor around screw terminal.

W. Use jumbo size plates for outlets installed in masonry walls.

X. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.04 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 26 05 37 to obtain mounting heights.

B. Install wall switch 48 inches above finished floor.

C. Install convenience receptacle 18 inches above finished floor.

D. Install convenience receptacle 6 inches above backsplash of counter.

E. Install telephone jack 18 inches above finished floor.

F. Install telephone jack for side-reach wall telephone to position top of telephone at 54 inches above finished floor.

G. Install telephone jack for forward-reach wall telephone to position top of telephone at 48 inches above finished floor.

H. Coordinate installation of access floor boxes with access floor system provided under Section 09 69 00.

I. Coordinate the installation of wiring devices with underfloor duct service fittings provided under Section 26 05 40.

3.05 FIELD QUALITY CONTROL

A. Perform field inspection, testing, adjusting, and balancing in accordance with Section 01 40 00.

B. Inspect each wiring device for damage and defects.

C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

D. Operate each wall switch with circuit energized and verify proper operation.

E. Verify that each receptacle device is energized.

F. Test each receptacle to verify operation and proper polarity.

G. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

H. Correct wiring deficiencies and replace damaged or defective wiring devices.

I. Verify that each telephone jack is properly connected and circuit is operational.

3.06 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.07 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 26 27 26

SECTION 26 28 13
FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fuses.

1.02 RELATED REQUIREMENTS

A. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

B. Section 26 05 73 - Overcurrent Protective Device Coordination Study: Additional criteria for the selection of protective devices specified in this section.

C. Section 26 24 13 - Switchboards: Fusible switches.

D. Section 26 24 16 - Panelboards: Fusible switches.

E. Section 26 28 18 - Enclosed Switches: Fusible switches.

F. Section 26 29 13 - Enclosed Controllers: Fusible switches.

1.03 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses.

B. NFPA 70 - National Electrical Code.

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements.

D. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses.

E. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
      a. Fusible Switches for Enclosed Motor Controllers: See Section 26 29 13.
   2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
   3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

C. Maintenance Materials: Furnish the following for North Providence School Department's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Fuses: One set(s) of three for each type and size installed.
   3. Fuse Pullers: One set(s) compatible with each type and size installed.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

E. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.07 MAINTENANCE MATERIALS

A. See Section 01 60 00 - Product Requirements, for additional provisions.

B. Furnish two fuse pullers.

C. Furnish three of each size and type fuse installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cooper Bussmann, a division of Cooper Industries: www.cooperindustries.com/#sle.

B. Mersen (formerly Ferraz Shawmut): ferrazshawmut.mersen.com.

C. Littelfuse, Inc: www.littelfuse.com/#sle.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 APPLICATIONS

A. Service Entrance:
   1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.

B. General Purpose Branch Circuits: Class RK1, time-delay.

C. Primary Protection for Control Transformers: Class CC, time-delay.

2.03 FUSES

A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose indicated.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Class R Fuses: Comply with UL 248-12.

H. Class CC Fuses: Comply with UL 248-4.

I. Power Load Feeder Switches: Class RK1 (time delay).

J. Motor Load Feeder Switches: Class RK1 (time delay).

K. Other Feeder Switches: Class RK1 (time delay).

L. General Purpose Branch Circuits: Class RK1 (time delay).

M. Motor Branch Circuits: Class L time delay.

N. Lighting Branch Circuits: Class G.

2.04 CLASS RK1 (TIME DELAY) FUSES

A. Manufacturers:
   1. Bussman Corp.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Construction: Current limiting, dual-element fuse, 10 seconds minimum at 500% rated amps, with copper fuse element.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION 26 28 13

SECTION 26 28 17
ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed circuit breakers.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 05 73 - Overcurrent Protective Device Coordination Study: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

E. NFPA 70 - National Electrical Code.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations.

H. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.

I. UL 869A - Reference Standard for Service Equipment.

J. UL 943 - Ground-Fault Circuit-Interrupters.

K. UL 1053 - Ground-Fault Sensing and Relaying Equipment.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for circuit breakers, enclosures, and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.

2. Include documentation of listed series ratings.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Maintain one copy of each document on site.

D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed circuit breaker internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature between 23 degrees F and 104 degrees F during and after installation of enclosed circuit breakers.

1.09 EXTRA MATERIALS

A. See Section 01 60 00 - Product Requirements, for additional provisions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation; Cutler-Hammer Products: www.eaton.com/#sle.

B. General Electric Company: www.geindustrial.com/#sle.

C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

D. Substitutions: See Section 01 60 00 - Product Requirements.

E. Source Limitations: Furnish enclosed circuit breakers and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED CIRCUIT BREAKERS

A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.

B. Provide products listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose indicated.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
1. Altitude: Less than 6,600 feet.
2. Ambient Temperature: Between 23 degrees F and 104 degrees F.

D. Short Circuit Current Rating:
1. Provide enclosed circuit breakers with listed short circuit current rating not less than the available fault current at the installed location indicated on the drawings.
2. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70.

3. Label equipment utilizing series ratings as required by NFPA 70.

E. Enclosed Circuit Breakers Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

F. Conductor Terminations: Suitable for use with the conductors to be installed.

G. Provide thermal magnetic circuit breakers unless otherwise indicated.

H. Provide electronic trip circuit breakers where indicated.

I. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

J. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.

K. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.
   2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
   3. Provide surface-mounted enclosures unless otherwise indicated.

L. Provide externally operable handle with means for locking in the OFF position.

M. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
   1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
   2. Where accessory ground fault sensing and relaying equipment is used, equip companion circuit breakers with ground-fault shunt trips.
      a. Use zero sequence ground fault detection method unless otherwise indicated.
      b. Provide test panel and field-adjustable ground fault pick-up and delay settings.

2.03 MOLDED CASE CIRCUIT BREAKERS

A. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.

B. Interrupting Capacity:
   1. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
      a. 14000 min. rms symmetrical amperes at 240 VAC or 208 VAC.
      b. 21000 min. rms symmetrical amperes at 480 VAC.
   2. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
   3. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.

C. Conductor Terminations:
   1. Provide mechanical lugs unless otherwise indicated.
   2. Lug Material: Copper, suitable for terminating copper conductors only.

D. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
   1. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
   2. Provide interchangeable trip units for circuit breaker frame sizes 225 amperes and larger.

E. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
   1. Provide the following field-adjustable trip response settings:
      a. Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
      b. Long time delay.
      c. Short time pickup and delay.
      d. Instantaneous pickup.
      e. Ground fault pickup and delay where ground fault protection is indicated.

F. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

G. Provide the following circuit breaker types where indicated:
   1. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.

H. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting.

I. Provide the following features and accessories where indicated or where required to complete installation:
   1. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.

J. Molded Case Circuit Breakers: UL listed for the following service conditions:
   1. Temperature: 95 degrees F.
   2. Altitude: 1000 feet.

2.04 TRIP UNITS

A. Field-Adjustable Trip Circuit Breakers: Provide circuit breakers with frame sizes 200 amperes and larger with mechanism for adjusting long time continuous current, short time pickup current setting for automatic operation. Range of Adjustment: amperes.

B. Field-Changeable Ampere Rating Circuit Breaker: Provide circuit breakers with frame sizes 250 amperes and larger with changeable trip units.

C. Current Limiting Circuit Breaker: Provide circuit breaker as indicated with automatically-resetting current limiting elements in each pole. Let-through Current and Energy: Less than permitted for same size Class RK-5 fuse.

D. Solid-State Circuit Breaker: Provide circuit breaker as scheduled with electronic sensing, timing and tripping circuits for adjustable current settings; ground fault trip with zero sequence type ground fault sensor; instantaneous trip.

2.05 CURRENT LIMITERS

A. Current Limiters: Designed for application with molded case circuit breaker.

B. Coordinate limiter size with trip rating of circuit breaker to prevent nuisance tripping and to achieve interrupting current rating specified for circuit breaker.

C. Provide interlocks to trip circuit breaker and to prevent closing circuit breaker when limiter compartment cover is removed or when one or more limiter is not in place or has operated.

2.06 ACCESSORIES

A. Enclosures:
   1. Fabricate enclosures from steel.
   2. Finish: Manufacturer's standard enamel finish, gray color.

B. Provide accessories as scheduled.

C. Handle Lock: Include provisions for padlocking.

D. Provide mechanical trip device.

E. Provide grounding lug in each enclosure.

F. Provide products suitable for use as service entrance equipment where so applied.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that the ratings of the enclosed circuit breakers are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed circuit breakers.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install enclosed circuit breakers where indicated, in accordance with manufacturer's instructions.

B. Install enclosed circuit breakers securely, in a neat and workmanlike manner in accordance with NECA 1.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required supports in accordance with Section 26 05 29.

E. Install enclosed circuit breakers plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed circuit breakers such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 05 26.

H. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

I. Height: 5 feet to operating handle.

J. Provide identification nameplates for each enclosed circuit breaker in accordance with Section 26 05 53.

K. Provide arc flash warning labels in accordance with NFPA 70.

3.03 FIELD QUALITY CONTROL

A. Perform inspection, testing, and adjusting in accordance with Section 01 40 00.

B. Inspect and test in accordance with manufacturer's instructions and NETA STD ATS, except Section 4.

C. Perform inspections and tests listed in NETA STD ATS, Section 7.6.1.1 for circuit breakers used for service entrance and for circuit breakers larger than 400 amperes. Tests listed as optional are not required.

D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

E. Test GFCI circuit breakers to verify proper operation.

F. Test shunt trips to verify proper operation.

G. Correct deficiencies and replace damaged or defective enclosed circuit breakers.

H. Perform field inspection and testing in accordance with Section 01 40 00.

I. Inspect and test each circuit breaker.

J. Inspect each circuit breaker visually.

K. Perform several mechanical ON-OFF operations on each circuit breaker.

L. Verify circuit continuity on each pole in closed position.

M. Determine that circuit breaker will trip on overcurrent condition, with tripping time to NEMA AB 1 requirements.

N. Include description of testing and results in test report.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from circuit breaker enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 28 17

SECTION 26 28 18
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.

B. Fusible switches.

C. Nonfusible switches.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 05 73 - Overcurrent Protective Device Coordination Study: Additional criteria for the selection of equipment and associated protective devices specified in this section.

E. Section 26 28 13 - Fuses.

F. Section 26 29 13 - Enclosed Controllers: Manual motor controllers.

G. Section 26 36 00 - Transfer Switches: Automatic and non-automatic switches listed for use as transfer switch equipment.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

C. NEMA FU 1 - Low Voltage Cartridge Fuses; National Electrical Manufacturers Association.

D. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum).

E. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

F. NFPA 70 - National Electrical Code.

G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations.

H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations.

I. UL 98 - Enclosed and Dead-Front Switches.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

C. Project Record Documents: Record actual locations of enclosed switches.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation; Cutler-Hammer Products; Model : www.eaton.com/#sle.

B. General Electric Company; Model : www.geindustrial.com/#sle.

C. Schneider Electric; Square D Products; Model : www.schneider-electric.us/#sle.

D. Substitutions: See Section 01 60 00 - Product Requirements.

E. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Short Circuit Current Rating:

G. Provide with switch blade contact position that is visible when the cover is open.

H. Fuse Clips for Fusible Switches: As required to accept fuses indicated.

I. Conductor Terminations: Suitable for use with the conductors to be installed.

J. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

K. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.

L. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

M. Heavy Duty Switches:
   1. Products:
      a. Schneider Electric.
      b. General Electric Co.
      c. Cutler Hammer.
      d. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Comply with NEMA KS 1.
   3. Conductor Terminations:
      a. Provide mechanical lugs unless otherwise indicated.
      b. Provide compression lugs where indicated.
      c. Lug Material: Copper, suitable for terminating copper conductors only.
   4. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

2.03 COMPONENTS

A. Fusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch.
   1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
   2. Handle lockable in OFF position.
   3. Fuse clips: Designed to accommodate NEMA FU1, Class R fuses.

B. Nonfusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch.
   1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
   2. Handle lockable in OFF position.

C. Enclosures: NEMA KS 1.
   1. Interior Dry Locations: Type 1.
   2. Exterior Locations: Type 3R.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install enclosed switches in accordance with manufacturer's instructions.

B. Install enclosed switches securely, in a neat and workmanlike manner in accordance with NECA 1.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required supports in accordance with Section 26 05 29.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 05 26.

H. Provide fuses complying with Section 26 28 13 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

I. Provide identification nameplate for each enclosed switch in accordance with Section 26 05 53.

J. Provide arc flash warning labels in accordance with NFPA 70.

K. Install fuses in fusible disconnect switches.

L. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection, testing, and adjusting in accordance with Section 01 40 00.

B. Inspect and test in accordance with NETA STD ATS, except Section 4.

C. Perform inspections and tests listed in NETA STD ATS, Section 7.5.1.1.

D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 28 18

SECTION 26 29 13
ENCLOSED CONTROLLERS

PART 2 PRODUCTS

1.01 ENCLOSED CONTROLLERS

A. Provide enclosed controller assemblies consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Description: Enclosed controllers complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; ratings, configurations and features as indicated on the drawings.

D. Service Conditions:
   1. Provide controllers and associated components suitable for operation under the following service conditions without derating:
      a. Altitude:
         1) Class 1 Km Equipment (devices utilizing power semiconductors, e.g. variable frequency controllers): Less than 3,300 feet.
         2) Class 2 Km Equipment (electromagnetic and manual devices): Less than 6,600 feet.
      b. Ambient Temperature: Between 32 degrees F and 104 degrees F.
   2. Provide controllers and associated components suitable for operation at indicated ratings under the service conditions at the installed location.

E. Short Circuit Current Rating:

F. Conductor Terminations: Suitable for use with the conductors to be installed.

G. Enclosures:
   1. Comply with NEMA ICS 6.
   2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   3. Finish: Manufacturer's standard unless otherwise indicated.

H. Instrument Transformers:
   1. Comply with IEEE C57.13.
   2. Select suitable ratio, burden, and accuracy as required for connected devices.
   3. Current Transformers: Connect secondaries to shorting terminal blocks.
   4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

1.02 OVERCURRENT PROTECTIVE DEVICES

A. Overload Relays:
   1. Provide overload relays and, where applicable, associated current elements/heaters, selected according to actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.
   2. Inverse-Time Trip Class Rating: Class 20 unless otherwise indicated or required.
   3. Trip-free operation.
   4. Visible trip indication.
   5. Resettable.
      a. Employ manual reset unless otherwise indicated.
      b. Do not employ automatic reset with two-wire control.

END OF SECTION 26 29 13

SECTION 26 29 23
VARIABLE-FREQUENCY MOTOR CONTROLLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable frequency controllers.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Housekeeping pads.

B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

C. Section 26 28 13 - Fuses.

1.03 REFERENCE STANDARDS

A. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable-Speed Drive Systems.

B. NEMA ICS 61800-2 - Adjustable Speed Electrical Power Drive Systems, Part 2: General Requirements-Rating Specifications for Low Voltage Adjustable Frequency AC Power Drive Systems.

C. NEMA ICS 7 - Industrial Control and Systems: Adjustable-Speed Drives.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

F. NFPA 70 - National Electrical Code.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.

C. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.

D. Test Reports: Indicate field test and inspection procedures and test results.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Manufacturer's Field Reports: Indicate start-up inspection findings.

G. Operation Data: NEMA ICS 7.1. Include instructions for starting and operating controllers, and describe operating limits that may result in hazardous or unsafe conditions.

H. Maintenance Data: NEMA ICS 7.1. Include routine preventive maintenance schedule.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB: www.ABB.com.

B. Schneider Electric; Square D Products: www.schneider-electric.us.

C. Danfoss: www.danfoss.us.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DESCRIPTION

A. Variable Frequency Controllers: Enclosed controllers suitable for operating the indicated loads, in conformance with requirements of NEMA ICS 7. Select unspecified features and options in accordance with NEMA ICS 3.1.
   1. Employ pulse-width-modulated inverter system.
   2. Design for ability to operate controller with motor disconnected from output.
   3. Design to attempt five automatic restarts following fault condition before locking out and requiring manual restart.

B. Enclosures: NEMA 250, Type 1, suitable for equipment application in places regularly open to the public.

C. Finish: Manufacturer's standard enamel.

2.03 OPERATING REQUIREMENTS

A. Rated Input Voltage: 480 volts, three phase, 60 Hertz.

B. Motor Nameplate Voltage: 460 volts, three phase, 60 Hertz.

C. Displacement Power Factor: Between 1.0 and 0.95, lagging, over entire range of operating speed and load.

D. Operating Ambient: 0 degrees C to 40 degrees C.

E. Minimum Efficiency at Full Load: 85 percent.

F. Time to Stop: 5 seconds.

G. Volts Per Hertz Adjustment: Plus or minus 0 percent.

H. Current Limit Adjustment: 60 to 110 percent of rated.

I. Acceleration Rate Adjustment: 0.5 to 30 seconds.

J. Deceleration Rate Adjustment: 1 to 30 seconds.

K. Input Signal: 4 to 20 mA DC.

2.04 COMPONENTS

A. Display: Provide integral digital display to indicate output voltage, output frequency, and output current.

B. Status Indicators: Separate indicators for overcurrent, overvoltage, ground fault, overtemperature, and input power ON.

C. Furnish HAND-OFF-AUTOMATIC selector switch and manual speed control.

D. Include undervoltage release.

E. Control Power Source: Integral control transformer.

F. Door Interlocks: Furnish mechanical means to prevent opening of equipment with power connected, or to disconnect power if door is opened; include means for defeating interlock by qualified persons.

G. Safety Interlocks: Furnish terminals for remote contact to inhibit starting under both manual and automatic mode.

H. Control Interlocks: Furnish terminals for remote contact to allow starting in automatic mode.

I. Manual Bypass: Furnish contactor, motor running overload protection, and short circuit protection for full voltage, non-reversing operation of the motor. Include isolation switch to allow maintenance of inverter during bypass operation.

J. Emergency Stop: Use dynamic brakes for emergency stop function.

K. Disconnecting Means: Include integral fused disconnect switch on the line side of each controller.

L. Wiring Terminations: Match conductor materials and sizes indicated.

M. Line Reactor: Furnish line reactor (s) for harmonics mitigation.

2.05 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Factory test controllers in accordance with NEMA ICS 61800-2.

C. Shop inspect and perform standard productions tests for each controller.

D. Make completed controller available for inspection at manufacturer's factory prior to packaging for shipment. Notify North Providence School Department at least 7 days before inspection is allowed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surface is suitable for controller installation.

B. Do not install controller until building environment can be maintained within the service conditions required by the manufacturer.

C. Verify that field measurements are as indicated on shop drawings.

3.02 INSTALLATION

A. Install in accordance with NEMA ICS 7.1 and manufacturer's instructions.

B. Tighten accessible connections and mechanical fasteners after placing controller.

C. Provide fuses in fusible switches; refer to Section 26 28 13 for product requirements.

D. Select and install overload heater elements in motor controllers to match installed motor characteristics.

E. Identify variable frequency controllers in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A. Provide the service of the manufacturer's field representative to prepare and start controllers.

B. Perform field inspection and testing in accordance with Section 01 40 00.

C. Inspect and test in accordance with NETA STD ATS, except Section 4.

D. Perform inspections and tests listed in NETA STD ATS, Section 7.17.

E. Correct deficiencies and replace damaged or defective controllers or associated components.

3.04 ADJUSTING

A. Make final adjustments to installed controller to assure proper operation of load system. Obtain performance requirements from installer of driven loads.

3.05 CLOSEOUT ACTIVITIES

A. Demonstrate operation of controllers in automatic and manual modes.

3.06 MAINTENANCE

A. See Section 01 70 00 - Execution Requirements, for additional requirements relating to maintenance service.

B. Provide a separate maintenance contract for specified maintenance service.

C. Provide service and maintenance of controllers for one year from Date of Substantial Completion.

END OF SECTION 26 29 23

SECTION 26 32 13
ENGINE GENERATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Packaged engine generator system and associated components and accessories:
   1. Engine and engine accessory equipment.
   2. Alternator (generator).
   3. Generator set control system.
   4. Generator set enclosure.

B. Packaged engine generator set.

C. Heat exchanger.

D. Exhaust silencer, emissions controls, and fittings.

E. Remote control panel.

F. Battery and charger.

G. Sound enclosure.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 23 11 13 - Facility Fuel-Oil Piping:
   1. Diesel fuel piping.

C. Section 23 31 00 - HVAC Ducts and Casings.

D. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

E. Section 26 05 29 - Hangers and Supports for Electrical Systems.

F. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

G. Section 26 36 00 - Transfer Switches.

1.03 REFERENCE STANDARDS

A. ASTM D975 - Standard Specification for Diesel Fuel.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction.

C. NECA/EGSA 404 - Standard for Installing Generator Sets.

D. NEMA MG 1 - Motors and Generators.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association.

F. NFPA 30 - Flammable and Combustible Liquids Code.

G. NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines.

H. NFPA 70 - National Electrical Code.

I. NFPA 99 - Health Care Facilities Code.

J. NFPA 110 - Standard for Emergency and Standby Power Systems.

K. UL 142 - Steel Aboveground Tanks for Flammable and Combustible Liquids.

L. UL 1236 - Battery Chargers for Charging Engine-Starter Batteries.

M. UL 2200 - Stationary Engine Generator Assemblies.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate compatibility of generator sets to be installed with work provided under other sections or by others.
    a. Transfer Switches: See Section 26 36 00.
2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for engine generator system.
3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
4. Coordinate the work to provide electrical circuits suitable for the power requirements of the actual auxiliary equipment and accessories to be installed.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Preinstallation Meeting: Convene one week before starting work of this section; require attendance of all affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features. Include alternator starting capabilities, engine fuel consumption rates, and cooling, combustion air, and exhaust requirements.
1. Include generator set sound level test data.
2. Include characteristic trip curves for overcurrent protective devices upon request.
3. Include alternator thermal damage curve upon request.

C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.

D. Specimen Warranty: Submit sample of manufacturer's warranty.

E. Evidence of qualifications for installer.

F. Evidence of qualifications for maintenance contractor (if different entity from installer).

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

H. Manufacturer's factory emissions certification.

I. Manufacturer's certification that products meet or exceed specified requirements.

J. Source quality control test reports.

K. Provide NFPA 110 required documentation from manufacturer where requested by authorities having jurisdiction, including but not limited to:
1. Certified prototype tests.
2. Torsional vibration compatibility certification.
3. NFPA 110 compliance certification.
4. Certified rated load test at rated power factor.

L. Manufacturer’s detailed field testing procedures.

M. Field quality control test reports.

N. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

O. Executed Warranty: Submit documentation of final executed warranty completed in North Providence School Department's name and registered with manufacturer.

P. Maintenance contracts.

Q. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

R. Maintenance Materials: Furnish the following for North Providence School Department's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Fuses: One of each type and size.
   3. Extra Filter Elements: One of each type, including fuel, oil and air.

S. Shop Drawings: Indicate electrical characteristics and connection requirements. Show plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, electrical diagrams including schematic and interconnection diagrams.

T. Product Data: Provide data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger, exhaust silencer, vibration isolators, day tank, and remote radiator.

U. Test Reports: Indicate results of performance testing.

V. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

W. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

X. Manufacturer's Field Reports: Indicate procedures and findings.

Y. Operation Data: Include instructions for normal operation.

Z. Maintenance Data: Include instructions for routine maintenance requirements, service manuals for engine and day tank, oil sampling and analysis for engine wear, and emergency maintenance procedures.

AA. Maintenance Materials and Tools: Furnish the following for North Providence School Department's use in maintenance of project.
   1. Extra Filter Elements: One of each type, including fuel, oil and air.
   2. Tools: One set of tools required for preventative maintenance of the engine generator system. Package tools in adequately sized metal tool box.

1.06 QUALITY ASSURANCE

A. Comply with the following:
   1. NFPA 70 (National Electrical Code).
   2. NFPA 110 (Standard for Emergency and Standby Power Systems); meet requirements for Level 1 system.
   3. NFPA 37 (Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines).
   4. NFPA 30 (Flammable and Combustible Liquids Code).

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
   1. Authorized service facilities located within 200 miles of project site.

D. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with engine generator systems of similar size, type, and complexity; manufacturer's authorized installer.

E. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.
   1. Contract maintenance office located within 200 miles of project site.

F. Products: Listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authorities having jurisdiction as suitable for the purpose indicated.

G. Conform to requirements of NFPA 70.
   1. Maintain one copy of each document on site.

H. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience with service facilities within 100 miles of Project.

I. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented experience.

J. Products: Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store generator sets in accordance with manufacturer's instructions and NECA/EGSA 404.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's instructions to avoid damage to generator set components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

C. Accept unit on site on skids. Inspect for damage.

D. Protect equipment from dirt and moisture by securely wrapping in heavy plastic.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Packaged Engine Generator Set - Basis of Design: Kohler Power Systems; Model 400REOZJB

B. Packaged Engine Generator Set - Other Acceptable Manufacturers:
   1. Caterpillar Inc: www.cat.com/power-generation.
   2. Cummins Power Generation Inc: www.cumminspower.com/#sle.
   3. Generac Power Systems: www.generac.com/industrial.

C. Substitutions: See Section 01 60 00 - Product Requirements.

D. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Owners Project Manager accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

E. Source Limitations: Furnish engine generator sets and associated components and accessories produced by a single manufacturer and obtained from a single supplier.

F. Caterpillar Inc: www.caterpillar.com.

G. Cummins Engine Company, I: www.cummins.com.

H. Kohler Power Systems: www.kohler.com.

I. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PACKAGED ENGINE GENERATOR SYSTEM

A. Provide new engine generator system consisting of all required equipment, sensors, conduit, boxes, wiring, piping, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. System Description:
   1. Application: _Stand by.
   2. Configuration: Single packaged engine generator set operated independently (not in parallel).

D. Packaged Engine Generator Set:
   1. Type: Diesel (compression ignition).
   2. Basis of Design: Kohler Power Systems Model 500REOJZB.
   3. Power Rating: As indicated on drawings, standby.
   4. Voltage: As indicated on drawings.
   5. Main Line Circuit Breaker:
      a. Type: Thermal magnetic.
      b. Trip Rating: Select according to generator set rating.
      c. Features:

E. Generator Set General Requirements:
   1. Prototype tested in accordance with NFPA 110 for Level 1 systems.
   2. Factory-assembled, with components mounted on suitable base.
   3. List and label engine generator assembly as complying with UL 2200.
   4. Power Factor: Unless otherwise indicated, specified power ratings are at 0.8 power factor for three phase voltages and 1.0 power factor for single phase voltages.
   5. Provide suitable guards to protect personnel from accidental contact with rotating parts, hot piping, and other potential sources of injury.
   6. Main Line Circuit Breakers: Provide factory-installed line side connections with suitable lugs for load side connections.

F. Service Conditions: Provide engine generator system and associated components suitable for operation under the service conditions at the installed location.
   1. Altitude: 1000 feet.
   2. Ambient Temperature: Between 0 and 104 degrees F.

G. Starting and Load Acceptance Requirements:
   1. Cranking Method: Cycle cranking complying with NFPA 110 (15 second crank period, followed by 15 second rest period, with cranking limiter time-out after 3 cycles), unless otherwise required.
   2. Cranking Limiter Time-Out: If generator set fails to start after specified cranking period, indicate overcrank alarm condition and lock-out generator set from further cranking until manually reset.
   3. Start Time: Capable of starting and achieving conditions necessary for load acceptance within 10 seconds (NFPA 110, Type 10).
   4. Maximum Load Step: Supports 100 percent of rated load in one step.

H. Exhaust Emissions Requirements:
   1. Comply with federal (EPA), state, and local regulations applicable at the time of commissioning; include factory emissions certification with submittals.
   2. Do not make modifications affecting generator set factory emissions certification without approval of manufacturer and Engineer. Where such modifications are made, provide field emissions testing as necessary for certification.

I. Sound Level Requirements:
   1. Do not exceed 69 dBA when measured at 23 feet from generator set in free field (no sound barriers) while operating at full load; include manufacturer's sound data with submittals.

J. Description: NFPA 110, engine generator system to provide source of power for Level 1 applications conforming to NFPA 99.

K. System Capacity: 500 kW, 625 kVA at elevation of 100 feet above sea level, continuous rating using engine-mounted radiator.

2.03 ENGINE AND ENGINE ACCESSORY EQUIPMENT

A. Provide engine with adequate horsepower to achieve specified power output at rated speed, accounting for alternator efficiency and parasitic loads.

B. Engine Fuel System - Diesel (Compression Ignition):
   1. Fuel Source: Diesel, ASTM D975 No. 2-D or approved cold weather diesel blends.
   2. Fuel Storage: Sub-base fuel tank.
   3. Engine Fuel Supply: Provide engine-driven, positive displacement fuel pump with replaceable fuel filter(s), water separator, check valve to secure prime, manual fuel priming pump, and relief-bypass valve. Provide fuel cooler where recommended by manufacturer.
   4. Engine Fuel Connections: Provide suitable, approved flexible fuel lines for coupling engine to fuel source.
   5. Sub-Base Fuel Tank:
      a. Provide sub-base mounted, double-wall fuel tank with secondary containment; listed and labeled as complying with UL 142.
      b. Tank Capacity: Size for minimum of 24 hours of continuous engine generator operation at 100 percent rated load, but not larger than permissible by applicable codes.
      c. Features:
         1) Direct reading fuel level gauge.
         2) Normal atmospheric vent.
         3) Emergency pressure relief vent.
         4) Fuel fill opening with lockable cap.
         5) Dedicated electrical conduit stub-up area.
         6) Low fuel level switch.
         7) Leak detection switch; located within secondary containment interstitial space for detection of primary tank fuel leak.

C. Engine Starting System:
   1. System Type: Electric, with DC solenoid-activated starting motor(s).
   2. Battery(s):
      a. Battery Type: Lead-acid.
      b. Battery Capacity: Size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature; capable of providing cranking through two complete periods of cranking limiter time-outs without recharging.
      c. Provide battery rack, cables, and connectors suitable for the supplied battery(s); size battery cables according to manufacturer's recommendations for cable length to be installed.
   3. Battery-Charging Alternator: Engine-driven, with integral solid-state voltage regulation.
   4. Battery Charger:
      a. Provide dual rate battery charger with automatic float and equalize charging modes and minimum rating of 10 amps; suitable for maintaining the supplied battery(s) at full charge without manual intervention.
      b. Capable of returning supplied battery(s) from fully discharged to fully charged condition within 24 hours, as required by NFPA 110 for Level 1 applications while carrying normal loads.
      c. Recognized as complying with UL 1236.
      d. Furnished with integral overcurrent protection; current limited to protect charger during engine cranking; reverse polarity protection.

e. Provide integral DC output ammeter and voltmeter with five percent accuracy.
f. Provide alarm output contacts as necessary for alarm indications.

5. Battery Heater: Provide thermostatically controlled battery heater to improve starting under cold ambient conditions.

D. Engine Speed Control System (Governor):
1. Single Engine Generator Sets (Not Operated in Parallel): Provide electronic isochronous governor for controlling engine speed/alternator frequency.
2. Frequency Regulation, Electronic Isochronous Governors: No change in frequency from no load to full load; plus/minus 0.25 percent at steady state.

E. Engine Lubrication System:
1. System Type: Full pressure, with engine-driven, positive displacement lubrication oil pump, replaceable full-flow oil filter(s), and dip-stick for oil level indication. Provide oil cooler where recommended by manufacturer.
2. Oil Heater: Provide thermostatically controlled oil heater to improve starting under cold ambient conditions.

F. Engine Cooling System:
1. System Type: Closed-loop, liquid-cooled, with unit-mounted radiator/fan and engine-driven coolant pump; suitable for providing adequate cooling while operating at full load under worst case ambient temperature.
2. Fan Guard: Provide suitable guard to protect personnel from accidental contact with fan.

G. Engine Air Intake and Exhaust System:
1. Air Intake Filtration: Provide engine-mounted, replaceable, dry element filter.
2. Engine Exhaust Connection: Provide suitable, approved flexible connector for coupling engine to exhaust system.
3. Exhaust Silencer: Provide critical grade or better exhaust silencer with sound attenuation not less than basis of design; select according to manufacturer's recommendations to meet sound performance requirements, where specified.

H. Type: Water-cooled inline or V-type, four stroke cycle, electric ignition natural-gas internal combustion engine.

I. Rating: Sufficient to operate under 10 percent overload for one hour in an ambient of 90 degrees F at elevation of 1000 feet.

J. Fuel System: Natural gas. Include manufacturer's approved regulator for pressure reduction from supply pressure.

K. Engine speed: 1800 rpm.

L. Governor: Isochronous type to maintain engine speed within 0.5 percent, steady state, and 5 percent, no load to full load, with recovery to steady state within 2 seconds following sudden load changes. Equip governor with means for manual operation and adjustment.

M. Safety Devices: Engine shutdown on high water temperature, low oil pressure, overspeed, and engine overcrank. Limits as selected by manufacturer.

N. Engine Starting: DC starting system with positive engagement, number and voltage of starter motors in accordance with manufacturer's instructions. Include remote starting control circuit, with MANUAL-OFF-REMOTE selector switch on engine-generator control panel.

O. Engine Jacket Heater: Thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90 degrees F, and suitable for operation on 120 volts AC.

P. Radiator: Radiator using glycol coolant, with blower type fan, sized to maintain safe engine temperature in ambient temperature of 110 degrees F. Radiator air flow restriction 0.5 inches of water maximum.

Q. Engine Accessories: Fuel filter, lube oil filter, intake air filter, lube oil cooler, fuel transfer pump, fuel priming pump, gear-driven water pump. Include fuel pressure gage, water temperature gage, and lube oil pressure gage on engine/generator control panel.

R. Mounting: Provide unit with suitable spring-type vibration isolators and mount on structural steel base.

2.04 ALTERNATOR (GENERATOR)

A. Alternator: 4-pole, 1800 rpm (60 Hz output) revolving field, synchronous generator complying with NEMA MG 1; connected to engine with flexible coupling; voltage output configuration as indicated, with reconnectable leads for 3 phase alternators.

B. Exciter:
   1. Exciter Type: Brushless; provide permanent magnet generator (PMG) excitation system; self-excited (shunt) systems are not permitted.
   2. PMG Excitation Short-Circuit Current Support: Capable of sustaining 300 percent of rated output current for 10 seconds.
   3. Voltage Regulation (with PMG excitation): Plus/minus 0.5 percent for any constant load from no load to full load.

C. Temperature Rise: Comply with UL 2200.

D. Insulation System: NEMA MG 1, Class H; suitable for alternator temperature rise.

E. Enclosure: NEMA MG 1, drip-proof.

F. Total Harmonic Distortion: Not greater than five percent.

G. Alternator Heater: Provide strip heater to prevent moisture condensation on alternator windings.

2.05 GENERATOR SET CONTROL SYSTEM

A. Provide microprocessor-based control system for automatic control, monitoring, and protection of generator set. Include sensors, wiring, and connections necessary for functions/indications specified.

B. Control Panel:
   1. Control Panel Mounting: Unit-mounted unless otherwise indicated; vibration isolated.
   2. Generator Set Control Functions:
      a. Automatic Mode: Initiates generator set start/shutdown upon receiving corresponding signal from remote device (e.g. automatic transfer switch).
      b. Manual Mode: Initiates generator set start/shutdown upon direction from operator.
      c. Reset Mode: Clears all faults, allowing generator set restart after a shutdown.
      d. Emergency Stop: Immediately shuts down generator set (without time delay) and prevents automatic restarting until manually reset.
      e. Cycle Cranking: Programmable crank time, rest time, and number of cycles.
      f. Time Delay: Programmable for shutdown (engine cooldown) and start (engine warmup).
      g. Voltage Adjustment: Adjustable through range of plus/minus 5 percent.
   3. Generator Set Status Indications:
      a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
      b. Current (Amps): For each phase.
      c. Frequency (Hz).
      d. Real power (W/kW).
      e. Reactive power (VAR/kVAR).
      f. Apparent power (VA/kVA).
      g. Power factor.
      h. Duty Level: Actual load as percentage of rated power.
      i. Engine speed (RPM).
      j. Battery voltage (Volts DC).
      k. Engine oil pressure.
      l. Engine coolant temperature.
      m. Engine run time.
      n. Generator powering load (position signal from transfer switch).
   4. Generator Set Protection and Warning/Shutdown Indications:

a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following protections/indications:
    1) Overcrank (shutdown).
    2) Low coolant temperature (warning).
    3) High coolant temperature (warning).
    4) High coolant temperature (shutdown).
    5) Low oil pressure (shutdown).
    6) Overspeed (shutdown).
    7) Low fuel level (warning).
    8) Low coolant level (warning/shutdown).
    9) Generator control not in automatic mode (warning).
    10) High battery voltage (warning).
    11) Low cranking voltage (warning).
    12) Low battery voltage (warning).
    13) Battery charger failure (warning).
b. In addition to NFPA 110 requirements, provide the following protections/indications:
    1) High AC voltage (shutdown).
    2) Low AC voltage (shutdown).
    3) High frequency (shutdown).
    4) Low frequency (shutdown).
    5) Overcurrent (shutdown).
    6) Fuel tank leak (warning), where applicable.
c. Provide contacts for local and remote common alarm.
d. Provide lamp test function that illuminates all indicator lamps.

5. Other Control Panel Features:
    a. Event log.
    b. Communications Capability: Compatible with system indicated. Provide all accessories necessary for proper interface.
    c. Remote monitoring capability via PC.

C. Remote Annunciator:
1. Remote Annunciator Mounting: Wall-mounted; Provide flush-mounted annunciator for finished areas and surface-mounted annunciator for non-finished areas unless otherwise indicated.
2. Generator Set Status Indications:
    a. Generator powering load (via position signal from transfer switch).
    b. Communication functional.
3. Generator Set Warning/Shutdown Indications:
    a. Comply with NFPA 110 for Level 1 systems including but not limited to the following indications:
        1) Overcrank (shutdown).
        2) Low coolant temperature (warning).
        3) High coolant temperature (warning).
        4) High coolant temperature (shutdown).
        5) Low oil pressure (shutdown).
        6) Overspeed (shutdown).
        7) Low fuel level (warning).
        8) Low coolant level (warning/shutdown).
        9) Generator control not in automatic mode (warning).
        10) High battery voltage (warning).
        11) Low cranking voltage (warning).
        12) Low battery voltage (warning).
        13) Battery charger failure (warning).
    b. Provide audible alarm with silence function.
    c. Provide lamp test function that illuminates all indicator lamps.

D. Remote Emergency Stop: Provide approved red, mushroom style remote emergency stop button where indicated or required by authorities having jurisdiction.

2.06 GENERATOR SET ENCLOSURE

A. Enclosure Type: Sound attenuating, weather protective.

B. Enclosure Material: Steel.

C. Hardware Material: Stainless steel.

D. Color: Manufacturer's standard.

E. Access Doors: Lockable, with all locks keyed alike.

F. Openings: Designed to prevent bird/rodent entry.

G. External Drains: Extend oil and coolant drain lines to exterior of enclosure for maintenance service.

H. Sound Attenuating Enclosures: Line enclosure with non-hydroscopic, self-extinguishing sound-attenuating material.

I. Exhaust Silencers: Where exhaust silencers are mounted within enclosure in main engine compartment, insulate silencer to minimize heat dissipation as necessary for operation at rated load under worst case ambient temperature.

J. Enclosure Space Heater: Provide thermostatically controlled enclosure space heater to prevent condensation and improve starting under cold ambient conditions; size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature.

2.07 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Perform production tests on generator sets at factory to verify operation and performance characteristics prior to shipment. Include certified test report with submittals.

C. Generator Set production testing to include, at a minimum:
   1. Operation at rated load and rated power factor.
   2. Single step load pick-up.
   3. Transient and steady state voltage and frequency performance.
   4. Operation of safety shutdowns.

D. Diesel Fuel Storage Tanks: Perform pressurized leak test prior to shipment.

E. Generator: NEMA MG 1, three phase, four pole, reconnectable brushless synchronous generator with brushless exciter.

F. Rating: 500 kW, 625 kVA, at 0.8 power factor, 480Y-277 volts, 60 Hz at 1800 rpm.

G. Insulation Class: F.

H. Temperature Rise: 130 degrees C Standby.

I. Enclosure: NEMA MG 1, open drip proof.

J. Voltage Regulation: Include generator-mounted volts per hertz exciter-regulator to match engine and generator characteristics, with voltage regulation plus or minus 1 percent from no load to full load. Include manual controls to adjust voltage droop, voltage level (plus or minus 5 percent) and voltage gain.

2.08 ACCESSORIES

A. Heat Exchanger: Engine or base-mounted heat exchanger and expansion tank of type and capacity recommended by engine manufacturer. Include solenoid shut-off valve for installation on the cooling water inlet, and connected to open when engine runs.

B. Exhaust Silencer: Residential type silencer, with muffler companion flanges and flexible stainless steel exhaust fitting, sized in accordance with engine manufacturer's instructions.

C. Batteries: Heavy duty, diesel starting type lead-acid storage batteries, 170 ampere-hours minimum capacity. Match battery voltage to starting system. Include necessary cables and clamps.

D. Battery Tray: Treated for electrolyte resistance, constructed to contain spillage.

E. Battery Charger: Current limiting type designed to float at 2.17 volts per cell and equalize at 2.33 volts per cell. Include overload protection, full wave rectifier, DC voltmeter and ammeter, and 120 volts AC fused input. Provide wall-mounted enclosure to meet NEMA 250, Type 1 requirements.

F. Line Circuit Breaker: Molded case circuit breaker on generator output with integral thermal and instantaneous magnetic trip in each pole, sized in accordance with NFPA 70; UL listed. Include battery-voltage operated shunt trip, connected to open circuit breaker on engine failure. Unit mount in enclosure to meet NEMA 250, Type 1 requirements.

G. Engine-Generator Control Panel: NEMA 250, Type 1 generator mounted control panel enclosure with engine and generator controls and indicators. Include provision for padlock and the following equipment and features:
   1. Frequency Meter: 45-65 Hz. range, 3.5 inch dial.
   2. AC Output Voltmeter: 3.5 inch dial, 2 percent accuracy, with phase selector switch.
   3. AC Output Ammeter: 3.5 inch dial, 2 percent accuracy, with phase selector switch.
   4. Output voltage adjustment.
   5. Push-to-test indicator lamps, one each for low oil pressure, high water temperature, overspeed, and overcrank.
   6. Engine start/stop selector switch.
   7. Engine running time meter.
   8. Oil pressure gage.
   9. Water temperature gage.
   10. Auxiliary Relay: 3PDT, operates when engine runs, with contact terminals prewired to terminal strip.
   11. Additional visual indicators and alarms as required by NFPA 110.
   12. Remote Alarm Contacts: Pre-wire SPDT contacts to terminal strip for remote alarm functions required by NFPA 110.

H. Remote Annunciator Panel: Surface mounted panel with brushed stainless steel. Provide audible and visible indicators and alarms required by NFPA 110.

I. Sub base fuel tank: 852 gallon (min.) capacity with fittings, vents, pumps, level indicators,complete with steel frame.

J. Emissions controls: Catalyst based, meeting State of Delaware Department of Natural Resourcese and Environmental Controls standards for stand-by generators.

K. Sound Enclosure:Lift based steel construction with hinged doors,.Accoustic insulation meeting UL94HF1 flammibility classification and repels moisture absorbption. Maximium sound level shall be 69 dB at 23.1 ft.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that the ratings and configurations of generator sets and auxiliary equipment are consistent with the indicated requirements.

C. Verify that rough-ins for field connections are in the proper locations.

D. Verify that mounting surfaces are ready to receive equipment.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1.

B. Install products in accordance with manufacturer's instructions.

C. Install generator sets and associated accessories in accordance with NECA/EGSA 404.

D. Arrange equipment to provide minimum clearances and required maintenance access.

E. Unless otherwise indicated, mount generator set on properly sized 6 inch high concrete pad constructed in accordance with Section 03 30 00. Provide suitable vibration isolators, where not factory installed.

F. Provide required support and attachment in accordance with Section 26 05 29.

G. Use manufacturer's recommended oil and coolant, suitable for the worst case ambient temperatures.

H. Provide diesel fuel piping and venting in accordance with Section 23 11 13, where not factory installed.

I. Provide engine exhaust piping in accordance with Section 23 51 00, where not factory installed.
   1. Include piping expansion joints, piping insulation, thimble, condensation trap/drain, rain cap, hangers/supports, etc. as indicated or as required.
   2. Do not exceed manufacturer's maximum back pressure requirements.

J. Install exhaust silencer in accordance with Section 23 51 00, where not factory installed.

K. Provide grounding and bonding in accordance with Section 26 05 26.

L. Identify system wiring and components in accordance with Section 26 05 53.

M. All incoming feeders shall enter from bottom of portable generator connection box and conduits shall exit from sides only.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Provide services of a manufacturer's authorized representative to prepare and start systems and perform inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.

C. Notify North Providence School Department and Architect at least two weeks prior to scheduled inspections and tests.

D. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

E. Provide all equipment, tools, and supplies required to accomplish inspection and testing, including load bank and fuel.

F. Preliminary inspection and testing to include, at a minimum:
   1. Inspect each system component for damage and defects.
   2. Verify tightness of mechanical and electrical connections are according to manufacturer's recommended torque settings.
   3. Check for proper oil and coolant levels.

G. Prepare and start system in accordance with manufacturer's instructions.

H. Perform acceptance test in accordance with NFPA 110.

I. Inspection and testing to include, at a minimum:
   1. Verify compliance with starting and load acceptance requirements.
   2. Verify voltage and frequency; make required adjustments as necessary.
   3. Verify phase sequence.
   4. Verify control system operation, including safety shutdowns.
   5. Verify operation of auxiliary equipment and accessories (e.g. battery charger, heaters, etc.).

J. Provide field emissions testing where necessary for certification.

K. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

L. Submit detailed reports indicating inspection and testing results and corrective actions taken.

M. Provide the services of manufacturer's representative to prepare and start system.

N. Perform field inspection and testing in accordance with Section 01 40 00.

O. Provide full load test utilizing portable test bank for four hours minimum. Simulate power failure including operation of transfer switch, automatic starting cycle, and automatic shutdown and return to normal.

P. Record in 20 minute intervals during four hour test:
   1. Kilowatts.
   2. Amperes.
   3. Voltage.
   4. Coolant temperature.
   5. Ambient temperature and humidity.
   6. Frequency.
   7. Oil pressure.

Q. Test alarm and shutdown circuits by simulating conditions.

R. Field-verify emissions levels to meet manufacturer's documented criteria per submittals.

3.04 ADJUSTING

A. Adjust generator output voltage and engine speed.

3.05 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. Demonstration: Demonstrate proper operation of system to North Providence School Department, and correct deficiencies or make adjustments as directed.

C. Training: Train North Providence School Department's personnel on operation, adjustment, and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of four hours of training.
   3. Instructor: Manufacturer's authorized representative.
   4. Location: At project site.

3.07 PROTECTION

A. Protect installed engine generator system from subsequent construction operations.

B. Demonstrate operation to North Providence School Department's operating personnel:
   1. Describe loads connected to emergency system and restrictions for future load additions.
   2. Simulate power outage by interrupting normal source, and demonstrate that system operates to provide emergency power.

3.08 MAINTENANCE

A. Provide to North Providence School Department a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of engine generator system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with a detailed schedule.

B. Provide trouble call-back service upon notification by North Providence School Department:
   1. Provide on-site response within 4 hours of notification.

2. Include allowance for call-back service during normal working hours at no extra cost to North Providence School Department.
3. North Providence School Department will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

C. Maintain an on-site log listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced.

D. Provide a separate maintenance contract for specified maintenance service.

E. Provide service and maintenance of engine generator for one year from Date of Substantial Completion.

END OF SECTION 26 32 13

SECTION 26 36 00
TRANSFER SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Transfer switches for low-voltage (600 V and less) applications and associated accessories:
   1. Automatic transfer switches.
   2. Remote annunciators.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 29 - Hangers and Supports for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 28 18 - Enclosed Switches: Safety switches not listed for use as transfer switch equipment.

F. Section 26 32 13 - Engine Generators: For interface with transfer switches.
   1. Includes code requirements applicable to work of this section.
   2. Includes additional testing requirements.

G. Section 26 32 13 - Engine Generators: Testing requirements.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

C. NEMA ICS 10 Part 1 - Industrial Control and Systems Part 1: Electromechanical AC Transfer Switch Equipment.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

E. NFPA 70 - National Electrical Code.

F. NFPA 110 - Standard for Emergency and Standby Power Systems.

G. UL 1008 - Transfer Switch Equipment.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate compatibility of transfer switches to be installed with work provided under other sections or by others.
   2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
   3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   4. Coordinate the work with placement of supports, anchors, etc. required for mounting.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Preinstallation Meeting: Convene one week before starting work of this section; require attendance of all affected installers.

C. Where work of this section involves interruption of existing electrical service, arrange service interruption with North Providence School Department.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features.
   1. Where applicable, include characteristic trip curves for overcurrent protective devices upon request.

C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

E. Manufacturer's certification that products meet or exceed specified requirements.

F. Source quality control test reports.

G. Manufacturer’s detailed field testing procedures.

H. Field quality control test reports.

I. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
   1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

J. Executed Warranty: Submit documentation of final executed warranty completed in North Providence School Department's name and registered with manufacturer.

K. Maintenance contracts.

L. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

M. Maintenance Materials: Furnish the following for North Providence School Department's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

N. Product Data: Provide catalog sheets showing voltage, switch size, ratings and size of switching and overcurrent protective devices, operating logic, short circuit ratings, dimensions, and enclosure details.

O. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

P. Operation Data: Instructions for operating equipment under emergency conditions when engine generator is running.

Q. Maintenance Data: Routine preventative maintenance and lubrication schedule. List special tools, maintenance materials, and replacement parts.

1.06 QUALITY ASSURANCE

A. Comply with the following:
   1. NFPA 70 (National Electrical Code).
   2. NFPA 110 (Standard for Emergency and Standby Power Systems); meet requirements for system Level specified in Section 26 32 13.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
   1. Authorized service facilities located within 200 miles of project site.

D. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with power transfer systems of similar size, type, and complexity; manufacturer's authorized installer.

E. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

G. Conform to requirements of NFPA 70.

H. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

I. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented experience.

J. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store transfer switches in accordance with manufacturer's instructions.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's instructions to avoid damage to transfer switch components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Transfer Switches - Basis of Design: ASCO power technologies 7000 series..

B. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.

C. Substitutions: See Section 01 60 00 - Product Requirements.

D. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Owners Project Manager accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

E. Source Limitations: Furnish transfer switches and accessories produced by a single manufacturer and obtained from a single supplier.

2.02 TRANSFER SWITCHES

A. Provide complete power transfer system consisting of all required equipment, conduit, boxes, wiring, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Applications:

1. Utilize open transition transfer unless otherwise indicated or required.

D. Construction Type: Only "contactor type" (open contact) transfer switches are acceptable. Do not use "breaker type" (enclosed contact) transfer switches.

E. Automatic Transfer Switch:
   1. Basis of Design: ASCO transfer swithces 7000 series, .

F. Comply with NEMA ICS 10 Part 1, and list and label as complying with UL 1008 for the classification of the intended application (e.g. emergency, optional standby).

G. Do not use double throw safety switches or other equipment not specifically designed for power transfer applications and listed as transfer switch equipment.

H. Load Classification: Classified for total system load (any combination of motor, electric discharge lamp, resistive, and tungsten lamp loads with tungsten lamp loads not exceeding 30 percent of the continuous current rating) unless otherwise indicated or required.

I. Switching Methods:
   1. Open Transition:
      a. Provide break-before-make transfer without a neutral position that is not connected to either source, and with interlocks to prevent simultaneous connection of the load to both sources.
   2. Obtain control power for transfer operation from line side of source to which the load is to be transferred.

J. Service Conditions: Provide transfer switches suitable for continuous operation at indicated ratings under the service conditions at the installed location.
   1. Altitude: 1000 feet.
   2. Ambient Temperature: Between 0 degrees F and 104 degrees F.

K. Enclosures:
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1 or Type 12.
      b. Outdoor Locations: Type 3R or Type 4.
   2. Provide lockable door(s) for outdoor locations.
   3. Finish: Manufacturer's standard unless otherwise indicated.

L. Short Circuit Current Rating:
   1. Withstand and Closing Rating: Provide transfer switches, when protected by the supply side overcurrent protective devices to be installed, with listed withstand and closing rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.
   2. Short Time Rating: Where the requirement for selectivity is indicated, provide transfer switches with short time ratings suitable for the maximum short time delay setting of the supply side overcurrent protective device.

M. Automatic Transfer Switches:
   1. Description: Transfer switches with automatically initiated transfer between sources; electrically operated and mechanically held.
   2. Control Functions:
      a. Automatic mode.
      b. Test Mode: Simulates failure of primary/normal source.
      c. Voltage and Frequency Sensing:
         1) Undervoltage sensing for each phase of primary/normal source; adjustable dropout/pickup settings.
         2) Undervoltage sensing for alternate/emergency source; adjustable dropout/pickup settings.
         3) Underfrequency sensing for alternate/emergency source; adjustable dropout/pickup settings.
      d. Outputs:

1) Contacts for engine start/shutdown (except where direct generator communication interface is provided).
2) Auxiliary contacts; one set(s) for each switch position.

e. Adjustable Time Delays:
1) Engine generator start time delay; delays engine start signal to override momentary primary/normal source failures.
2) Transfer to alternate/emergency source time delay.
3) Retransfer to primary/normal source time delay.
4) Engine generator cooldown time delay; delays engine shutdown following retransfer to primary/normal source to permit generator to run unloaded for cooldown period.

f. In-Phase Monitor (Open Transition Transfer Switches): Monitors phase angle difference between sources for initiating in-phase transfer.

g. Engine Exerciser: Provides programmable scheduled exercising of engine generator selectable with or without transfer to load; provides memory retention during power outage.

3. Status Indications:
a. Connected to alternate/emergency source.
b. Connected to primary/normal source.
c. Alternate/emergency source available.

4. Automatic Sequence of Operations:
a. Upon failure of primary/normal source for a programmable time period (engine generator start time delay), initiate starting of engine generator where applicable.
b. When alternate/emergency source is available, transfer load to alternate/emergency source after programmable time delay.
c. When primary/normal source has been restored, retransfer to primary/normal source after a programmable time delay. Bypass time delay if alternate/emergency source fails and primary/normal source is available.
d. Where applicable, initiate shutdown of engine generator after programmable engine cooldown time delay.

N. Remote Annunciators:
1. Remote Annunciator Mounting: Wall-mounted; Provide flush-mounted annunciator for finished areas and surface-mounted annunciator for non-finished areas unless otherwise indicated.
2. Transfer Switch Status Indications:
a. Connected to alternate/emergency source.
b. Connected to primary/normal source.
c. Alternate/emergency source available.
d. Primary/normal source available.

O. Interface with Other Work:
1. Interface with engine generators as specified in Section 26 32 13.
2.

2.03 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Perform production tests on transfer switches at factory to verify operation and performance characteristics prior to shipment. Include certified test report with submittals.

2.04 AUTOMATIC TRANSFER SWITCH

A. Description: NEMA ICS 10, automatic transfer switch 1000 amp,3 pole, in NEMA1 enclosure.

B. Configuration: Electrically operated, mechanically held transfer switch.

C. Interrupting Capacity: 65000 amp minimum ,rms .

2.05 SERVICE CONDITIONS

A. Service Conditions: NEMA ICS 10.

B. Temperature: 105 deg F.

C. Altitude: 3,300 feet.

2.06 COMPONENTS

A. Indicating Lights: Mount in cover of enclosure to indicate NORMAL SOURCE AVAILABLE.

B. Test Switch: Mount in cover of enclosure to simulate failure of normal source.

C. Return to Normal Switch: Mount in cover of enclosure to initiate manual transfer from alternate source to normal source.

D. Transfer Switch Auxiliary Contacts: 1 normally open; 1 normally closed.

E. Normal Source Monitor: Monitor each line of normal source voltage and frequency; initiate transfer when voltage drops below 85 percent or frequency varies more than 3 percent from rated nominal value.

F. Alternate Source Monitor: Monitor alternate source voltage and frequency; inhibit transfer when voltage is below 85 percent or frequency varies more than 3 percent from rated nominal value.

G. In-Phase Monitor: Inhibit transfer until source and load are within zero electrical degrees.

H. Switched Neutral: Overlapping contacts.

I. Enclosure: ICS 10, Type 1, finished with manufacturer's standard gray enamel.

J. Manual controls for automatic transfer switch.

K. Power meter

2.07 AUTOMATIC SEQUENCE OF OPERATION

A. Initiate Time Delay to Start Alternate Source Engine Generator: Upon initiation by normal source monitor.

B. Time Delay To Start Alternate Source Engine Generator: 0 to 6 seconds, adjustable.

C. Initiate Transfer Load to Alternate Source: Upon initiation by normal source monitor and permission by alternate source monitor.

D. Time Delay Before Transfer to Alternate Power Source: 0 to 60 seconds, adjustable.

E. Initiate Retransfer Load to Normal Source: Upon permission by normal source monitor.

F. Time Delay Before Transfer to Normal Power: 0 to 60 seconds, adjustable; bypass time delay in event of alternate source failure.

G. Time Delay Before Engine Shut Down: 0 to 1 minutes, adjustable, of unloaded operation.

H. Engine Exerciser: Start engine every 15days run for 30 minutes before shutting down. Bypass exerciser control if normal source fails during exercising period.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that the ratings and configurations of transfer switches are consistent with the indicated requirements.

C. Verify that rough-ins for field connections are in the proper locations.

D. Verify that surface is suitable for transfer switch installation.

3.02 PREPARATION

A. Provide 6" housekeeping pads.

3.03 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1.

B. Install in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances and required maintenance access.

D. Install transfer switches plumb and level.

E. Unless otherwise indicated, mount floor-mounted transfer switches on properly sized 3 inch high concrete pad constructed in accordance with Section 03 30 00.

F. Provide grounding and bonding in accordance with Section 26 05 26.

G. Identify transfer switches in accordance with Section 26 05 53.

H. Provide engraved plastic nameplates under the provisions of Section 26 05 53.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.

C. Prepare and start system in accordance with manufacturer's instructions.

D. Automatic Transfer Switches:
   1. Inspect and test in accordance with NETA ATS, except Section 4.
   2. Perform inspections and tests listed in NETA ATS, Section 7.22.3. The control wiring insulation-resistance tests listed as optional are not required.
      a. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

E. Provide additional inspection and testing as required for completion of associated engine generator testing as specified in Section 26 32 13.

F. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

G. Submit detailed reports indicating inspection and testing results and corrective actions taken.

H. Provide the services of the manufacturer's technical representative to check out transfer switch connections and operation and place in service.

I. Perform field inspection and testing in accordance with Section 01 40 00.

J. Inspect and test in accordance with NETA STD ATS, except Section 4.

K. Perform inspections and tests listed in NETA STD ATS, Section 7.22.3.

3.05 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of transfer switches to North Providence School Department, and correct deficiencies or make adjustments as directed.

D. Training: Train North Providence School Department's personnel on operation, adjustment, and maintenance of transfer switches.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

E. Demonstrate operation of transfer switch in bypass, normal, and emergency modes.

3.07 PROTECTION

A. Protect installed transfer switches from subsequent construction operations.

3.08 MAINTENANCE

A. See Section 01 70 00 - Execution Requirements, for additional requirements relating to maintenance service.

B. Provide to North Providence School Department a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of transfer switches for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with a detailed schedule.

C. Conduct site visit at least once every three months to perform inspection, testing, and preventive maintenance. Submit report to North Providence School Department indicating maintenance performed along with evaluations and recommendations.

D. Provide trouble call-back service upon notification by North Providence School Department:
   1. Provide on-site response within 4 hours of notification.
   2. Include allowance for call-back service during normal working hours at no extra cost to North Providence School Department.
   3. North Providence School Department will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

E. Maintain an on-site log listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced.

F. Provide a separate maintenance contract for specified maintenance service.

G. Provide service and maintenance of transfer switches for one year from Date of Substantial Completion.

END OF SECTION 26 36 00

SECTION 26 43 00
SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surge protective devices for service entrance locations.

B. Surge protective devices for distribution locations.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding.

B. Section 26 27 26 - Wiring Devices: Receptacles with integral surge protection.

C. Section 26 24 13 - Switchboards.

D. Section 26 24 16 - Panelboards.

E. Section 27 10 05 - Structured Cabling for Voice and Data: Protectors for communications service entrance.

1.03 ABBREVIATIONS AND ACRONYMS

A. EMI/RFI: Electromagnetic Interference/Radio Frequency Interference.

B. SPD: Surge Protective Device.

1.04 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

C. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

D. NFPA 70 - National Electrical Code.

E. UL 1449 - Standard for Surge Protective Devices.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to ordering equipment.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.

1. SPDs with EMI/RFI filter: Include noise attenuation performance.

C. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.

D. Certificates: Manufacturer's documentation of listing for compliance with the following standards:

1. UL 1449.
2. UL 1283 (for Type 2 SPDs).

E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.

G. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in North Providence School Department's name and registered with manufacturer.

H. Project Record Documents: Record actual connections and locations of surge protective devices.

1.07 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.08 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in accordance with manufacturer's written instructions.

1.09 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer's Warranty: Provide minimum five year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Schneider Electric; Square D Brand Surgelogic Products as indicated under product article(s) below; www.surgelogic.com.

B. Surge Protective Devices (SPD) as manufactured by Siemens Industry, Inc. are a permitted substitution with the inclusion of a Surge Counter and an External Operable Disconnect.

C. Surge Protective Devices (SPD) as manufactured by Advanced Protection Technologies, Inc. are a permitted substitution with inclusion of an externally operable switch / breaker.

D. Factory-installed, Internally Mounted Surge Protective Devices:
   1. Same as manufacturer of equipment containing surge protective device, to provide a complete listed assembly including SPD.

E. Source Limitations: Furnish surge protective devices produced by a single manufacturer and obtained from a single supplier.

2.02 ALL SURGE PROTECTIVE DEVICES

A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service, listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated; system voltage as indicated on the drawings.

B. Protected Modes:
   1. Wye Systems: L-N, L-G, N-G, L-L.

C. UL 1449 Voltage Protection Ratings (VPRs):
   1. Equivalent to basis of design.
   2. 480Y/277V System Voltage: Not more than 1,500 V for L-N, L-G, and N-G modes and 2,000 V for L-L mode.

D. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.

E. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   1. Indoor clean, dry locations: Type 1.

F. Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:

G. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.
   1. Switchboards: See Section 26 24 13.

2.03 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

A. Unless otherwise indicated, provide field-installed, externally mounted or factory-installed, internally mounted SPDs.

B. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.

C. Provide SPDs utilizing field-replaceable modular or non-modular protection circuits.

D. Surge Current Rating: Not less than 120 kA per mode/240 kA per phase.

E. Repetitive Surge Current Capacity: Not less than 5,000 impulses.

F. UL 1449 Nominal Discharge Current (I-n): 20 kA.

G. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.

H. Diagnostics:
   1. Protection Status Monitoring: Provide indicator lights to report the protection for each phase.
   2. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.

I. Basis of Design: Schneider Electric; Square D Brand Surgelogic Products; www.surgelogic.com.
   1. Field-installed, Externally Mounted Surge Protective Devices:
      a. EMA Series: Replaceable modules; 200 kA SCCR; individually fused MOVs, thermal fusing; dry contacts; EMI/RFI filtering; surge counter; duty cycle tested for 20,000 impulses; 10 year warranty.
   2. Factory-installed, Internally Mounted Surge Protective Devices:
      a. IMA Series: Replaceable modules; 200 kA SCCR; individually fused MOVs, thermal fusing; dry contacts; EMI/RFI filtering; surge counter; duty cycle tested for 20,000 impulses; 10 year warranty.

2.04 SURGE PROTECTIVE DEVICES FOR DISTRIBUTION LOCATIONS

A. Unless otherwise indicated, provide field-installed, externally mounted or factory-installed, internally mounted SPDs.

B. List and label as complying with UL 1449, Type 1 or Type 2.

C. Provide SPDs utilizing field-replaceable modular or non-modular protection circuits.

D. Surge Current Rating: Not less than 80 kA per mode/160 kA per phase.

E. UL 1449 Nominal Discharge Current (I-n): 20 kA.

F. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.

G. Diagnostics:
   1. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.

2. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.

H. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch or not direct bus connected.

I. Basis of Design: Schneider Electric; Square D Brand Surgelogic Products; www.surgelogic.com.
   1. Field-installed, Externally Mounted Surge Protective Devices:
      a. EMA Series: Replaceable modules; 200 kA SCCR; individually fused MOVs, thermal fusing; dry contacts; EMI/RFI filtering; surge counter; duty cycle tested for 20,000 impulses; 10 year warranty.
         1) Furnished with integral switch option where indicated.
   2. Factory-installed, Internally Mounted Surge Protective Devices:
      a. IMA Series: Replaceable modules; 200 kA SCCR; individually fused MOVs, thermal fusing; dry contacts; EMI/RFI filtering; surge counter; duty cycle tested for 20,000 impulses; 10 year warranty.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.

C. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of drawings and manufacturer's instructions.

D. Verify system grounding and bonding is in accordance with Section 26 05 26, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1.

B. Install SPD in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide conductors with minimum ampacity as indicated on the drawings, as required by NFPA 70, and not less than manufacturer's recommended minimum conductor size.

E. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably be rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.

F. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 26 05 26 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

3.03 FIELD QUALITY CONTROL

A. Perform inspection, testing, and adjusting in accordance with Section 01 40 00.

B. Inspect and test in accordance with NETA STD ATS, except Section 4.

C. Perform inspections and tests listed in NETA STD ATS Section 7.19.1.

D. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

3.04 CLEANING

A. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 43 00

SECTION 26 51 00
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

D. Ballasts.

E. Lamps.

F. Luminaire accessories.

1.02 RELATED REQUIREMENTS

A. Section 26 05 37 - Boxes.

B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

C. Section 26 09 23 - Lighting Control Devices: Automatic controls for lighting including occupancy sensors, outdoor motion sensors, time switches, outdoor photo controls, and daylighting controls.

D. Section 26 27 26 - Wiring Devices: Manual wall switches and wall dimmers.

E. Section 26 56 00 - Exterior Lighting.

1.03 REFERENCE STANDARDS

A. ANSI C78.379 - American National Standard for Electric Lamps -- Reflector Lamps -- Classification of Beam Patterns.

B. ANSI C82.1 - American National Standard for Lamp Ballast - Line Frequency Fluorescent Lamp Ballast.

C. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type).

D. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements.

E. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits.

F. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; Illuminating Engineering Society.

G. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules.

H. NECA 1 - Standard for Good Workmanship in Electrical Construction.

I. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems.

J. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems.

K. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association.

L. NFPA 70 - National Electrical Code.

M. NFPA 101 - Life Safety Code.

N. UL 924 - Emergency Lighting and Power Equipment.

O. UL 935 - Fluorescent-Lamp Ballasts.

P. UL 1598 - Luminaires.

Q. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
   2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
   3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
   4. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
   2. Provide photometric calculations where luminaires are proposed for substitution upon request.

C. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

D. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
      b. Include IES LM-79 test report upon request.

E. Sustainable Design Documentation: Submit manufacturer's product data on lamp mercury content and rated lamp life, showing compliance with specified requirements.

F. Field Quality Control Reports.

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

I. Maintenance Materials: Furnish the following for North Providence School Department's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.
   3. Extra Lamps: Ten percent of total quantity installed for each type, but not less than two of each type.
   4. Extra Ballasts: Two percent of total quantity installed for each type, but not less than one of each type.

J. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Conform to requirements of NFPA 70 and NFPA 101.

D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

1.10 EXTRA MATERIALS

A. See Section 01 60 00 - Product Requirements, for additional provisions.

B. Furnish two of each plastic lens type.

C. Furnish one replacement lamps for each lamp type.

D. Furnish two of each ballast type.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acuity Brands, Inc; : www.acuitybrands.com.

B. Hubbell Lighting, Inc; : www.hubbelllighting.com.

C. Lightolier: www.lightolier.com.

D. Lithonia Lighting: www.lithonia.com.

E. Columbia Lighting.

F. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 LUMINAIRES

A. Manufacturers:
   1. Acuity Brands, Inc; : www.acuitybrands.com/#sle.
   2. Cooper Lighting, a division of Cooper Industries; : www.cooperindustries.com/#sle.
   3. Hubbell Lighting, Inc; : www.hubbelllighting.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Provide products that comply with requirements of NFPA 70.

C. Provide products that are listed and labeled as complying with UL 1598, where applicable.

D. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

H. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 200,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

I. LED Luminaires: Listed and labeled as complying with UL 8750.

J. Track Lighting Systems: Provide track compatible with specified track heads, with all connectors, power feed fittings, dead ends, hangers and canopies as necessary to complete installation.

K. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.03 EMERGENCY LIGHTING UNITS

A. Manufacturers:
   1. Acuity Brands, Inc; : www.acuitybrands.com/#sle.
   2. Cooper Lighting, a division of Cooper Industries; : www.cooperindustries.com/#sle.
   3. Hubbell Lighting, Inc; : www.hubbelllighting.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924. Emergency and Exit light combination unit with (2) unit mounted lamps and LED exit light with battery backup. Thois cmobination unit shall have spare capacity to power remote emergency lamp heads.

C. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

D. Battery:
   1. Sealed maintenance-free nickel cadmium unless otherwise indicated.
   2.
   3. Size battery to supply all connected lamps, including emergency remote heads where indicated.

E. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

F. Provide low-voltage disconnect to prevent battery damage from deep discharge.

G. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

H. Accessories:
   1. Provide compatible accessory mounting brackets where indicated or required to complete installation.
   2. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
   3. Provide compatible accessory wire guards where indicated.
   4. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

2.04 LUMINAIRES

A. Furnish products as indicated in Schedule attached to this section.

B. Substitutions: See Section 01 60 00 - Product Requirements.
   1. Input Voltage: 120 or 277 volts.

2.05 EXIT SIGNS

A. Manufacturers:
   1. Acuity Brands, Inc; : www.acuitybrands.com/#sle.
   2. Cooper Lighting, a division of Cooper Industries; : www.cooperindustries.com/#sle.
   3. Hubbell Lighting, Inc; : www.hubbelllighting.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. All Exit Signs: Internally illuminated with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
   1. Number of Faces: Single or double as indicated or as required for the installed location.
   2. Directional Arrows: As indicated or as required for the installed location.

C. Self-Powered Exit Signs:
   1. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
   2. Battery: Sealed maintenance-free nickel cadmium unless otherwise indicated.
   3. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
   4. Provide low-voltage disconnect to prevent battery damage from deep discharge.
   5. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

D. Accessories:
   1. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
   2. Provide compatible accessory wire guards where indicated.

E. Manufacturers: As indicated on lighting fixture schedule.
   1. Substitutions: See Section 01 60 00 - Product Requirements.

F. Exit Signs: Exit sign fixture .
   1. Housing: Plastic.
   2. Face: Translucent glass face with red letters on white background.
   3. Face: Aluminum stencil face with red letters.
   4. Directional Arrows: Universal type for field adjustment.
   5. Mounting: Universal, for field selection.
   6. Battery: 12 volt, nickel-cadmium type, with 1.5 hour capacity.
   7. Battery Charger: Dual-rate type, with sufficient capacity to recharge discharged battery to full charge within twelve hours.
   8. Lamps: Manufacturer's standard.
   9. Input Voltage: 120/277 volts.

2.06 BALLASTS

A. Manufacturers:
   1. General Electric Company/GE Lighting; : www.gelighting.com/#sle.
   2. Osram Sylvania; : www.sylvania.com/#sle.
   3. Philips Lighting Electronics/Advance; : www.advance.philips.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.
   5. Manufacturer Limitations: Where possible, for each type of luminaire provide ballasts produced by a single manufacturer.

B. All Ballasts:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).

2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

C. Fluorescent Ballasts:
1. All Fluorescent Ballasts: Unless otherwise indicated, provide high frequency electronic ballasts complying with ANSI C82.11 and listed and labeled as complying with UL 935.
a. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 10 percent.
b. Total Harmonic Distortion: Not greater than 10 percent.
c. Power Factor: Not less than 0.95.
d. Thermal Protection: Listed and labeled as UL Class P, with automatic reset for integral thermal protectors.
e. Sound Rating: Class A, suitable for average ambient noise level of 20 to 24 decibels.
f. Lamp Compatibility: Specifically designed for use with the specified lamp, with no visible flicker.
g. Lamp Operating Frequency: Greater than 20 kHz, except as specified below.
1) Do not operate lamp(s) within the frequencies from 30 kHz through 40 kHz in order to avoid interference with infrared devices.
h. Lamp Current Crest Factor: Not greater than 1.7.
i. Provide automatic restart capability to restart replaced lamp(s) without requiring resetting of power.
j. Provide end of lamp life automatic shut down circuitry for T5 and smaller diameter lamp ballasts.
k. Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location category A.
l. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of CFR, Title 47, Part 18, for Class A, non-consumer application.
m. Provide high efficiency T8 lamp ballasts certified as NEMA premium where indicated.
n. Ballast Marking: Include wiring diagrams with lamp connections.
2. Non-Dimming Fluorescent Ballasts:
a. Lamp Starting Method:
1) T8 Lamp Ballasts: Programmed start unless otherwise indicated.
2) T5 Lamp Ballasts: Programmed start unless otherwise indicated.
3) Compact Fluorescent Lamp Ballasts: Programmed start unless otherwise indicated.
b. Lamp Starting Temperature: Capable of starting standard lamp(s) at a minimum of 0 degrees F, and energy saving lamp(s) at a minimum of 60 degrees F unless otherwise indicated.

2.07 LAMPS

A. Manufacturers:
1. General Electric Company/GE Lighting; : www.gelighting.com/#sle.
2. Osram Sylvania; : www.sylvania.com/#sle.
3. Philips Lighting Company; : www.lighting.philips.com.
4. Philips Lighting Co of NA: www.lighting.philips.com.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. All Lamps:
1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.

4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.

C. Compact Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.
   1. Low Mercury Content: Provide lamps that pass the EPA Toxicity Characteristic Leaching Procedure (TCLP) test for characteristic hazardous waste.
   2. Correlated Color Temperature (CCT): 3,500 K unless otherwise indicated.
   3. Color Rendering Index (CRI): Not less than 80.
   4. Average Rated Life: Not less than 10,000 hours for an operating cycle of three hours per start.

D. Linear Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.
   1. Low Mercury Content: Provide lamps that pass the EPA Toxicity Characteristic Leaching Procedure (TCLP) test for characteristic hazardous waste.
   2. T8 Linear Fluorescent Lamps:
      a. Correlated Color Temperature (CCT): 3,500 K unless otherwise indicated.
      b. Color Rendering Index (CRI): Not less than 80.
      c. Average Rated Life: Not less than 20,000 hours for an operating cycle of three hours per start.
   3. T5 Linear Fluorescent Lamps:
      a. Correlated Color Temperature (CCT): 3,500 K unless otherwise indicated.
      b. Color Rendering Index (CRI): Not less than 80.
      c. Average Rated Life: Not less than 20,000 hours for an operating cycle of three hours per start.

E. Lamp Types: As specified for each luminaire.

F. Fluorescent Lamps:
   1. Product: Phillips Lighting - Type T5 or T8.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

G. High Intensity Discharge (HID) Lamps:
   1. Product: Match Lighting Fixture Type
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.08 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

D. Tube Guards for Linear Fluorescent Lamps: Provide clear virgin polycarbonate sleeves with endcaps where indicated.

E. Product: As indicated in lighting fixture schedule.
   1. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of luminaires provided under this section.

B. Install products according to manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship), NECA 500 (commercial lighting), and NECA 502 (industrial lighting).

D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

E. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
   3. Secure pendant-mounted luminaires to building structure.
   4. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
   5. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gage, connected from opposing corners of each recessed luminaire to building structure.
   6. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

F. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
   3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

G. Suspended Luminaires:
   1. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
   2. Install canopies tight to mounting surface.

H. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

I. Install fixtures securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting).

J. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.

K. Support luminaires independent of ceiling framing.

L. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.

M. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.

N. Exposed Grid Ceilings: Support surface mounted luminaires in grid ceiling directly from building structure.

O. Exposed Grid Ceilings: Provide auxiliary members spanning ceiling grid members to support surface mounted luminaires.

P. Exposed Grid Ceilings: Fasten surface mounted luminaires to ceiling grid members using bolts, screws, rivets, or suitable clips.

Q. Install recessed luminaires to permit removal from below.

R. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

S. Install clips to secure recessed grid-supported luminaires in place.

T. Install wall mounted luminaires, emergency lighting units, and exit signs at height as scheduled.

U. Install accessories furnished with each luminaire.

V. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

W. Bond products and metal accessories to branch circuit equipment grounding conductor.

X. Install specified lamps in each emergency lighting unit, exit sign, and luminaire.

Y. Air Handling Luminaires: Interface with air handling accessories furnished and installed under Section 23 36 00.

Z. Emergency Lighting Units:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

AA. Exit Signs:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

AB. Install lamps in each luminaire.

AC. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Perform field inspection, testing, and adjusting in accordance with Section 01 40 00.

D. Operate each luminaire after installation and connection to verify proper operation.

E. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.

F. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

D. Aim and adjust luminaires as indicated.

E. Position exit sign directional arrows as indicated.

3.06 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

B. Clean electrical parts to remove conductive and deleterious materials.

C. Remove dirt and debris from enclosures.

D. Clean photometric control surfaces as recommended by manufacturer.

E. Clean finishes and touch up damage.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. Just prior to Substantial Completion, replace all lamps that have failed.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

3.09 PROTECTION

A. Relamp luminaires that have failed lamps at Substantial Completion.

3.10 SCHEDULE - ATTACHED

END OF SECTION 26 51 00

SECTION 26 55 61
THEATRICAL LIGHTING

PART 2 PRODUCTS

1.01 LIGHTING CONTROL COMPONENTS

A. Lighting Dimming and Control System: For stage area and house lighting.

B. Dimmers: Portable dimming unit suitable for mounting at lighting unit.

END OF SECTION 26 55 61

SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior luminaires.

B. Ballasts.

C. Lamps.

D. Poles and accessories.

E. Luminaire accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 37 - Boxes.

D. Section 26 27 26 - Wiring Devices: Receptacles for installation in poles.

E. Section 26 28 13 - Fuses.

F. Section 26 51 00 - Interior Lighting.

1.03 REFERENCE STANDARDS

A. AASHTO LTS - Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signal.

B. ANSI O5.1 - American National Standard for Wood Poles -- Specifications and Dimensions.

C. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information.

D. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules.

E. IESNA LM-64 - Photometric Measurements of Parking Areas.

F. NECA 1 - Standard for Good Workmanship in Electrical Construction.

G. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems.

H. NFPA 70 - National Electrical Code.

I. UL 1598 - Luminaires.

J. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
2. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
2. Provide photometric calculations where luminaires are proposed for substitution .

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
   2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IESNA LM-63 standard format upon request.
   3. Lamps: Include rated life and initial and mean lumen output.
   4. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.

D. Sustainable Design Documentation: Submit manufacturer's product data on lamp mercury content and rated lamp life, showing compliance with specified requirements.

E. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed and comply with designated structural design criteria.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

G. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

H. Maintenance Materials: Furnish the following for North Providence School Department's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

I. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

C. Receive, handle, and store wood poles in accordance with ANSI O5.1.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acuity Brands, Inc; : www.acuitybrands.com.

B. Hubbell Lighting, Inc; : www.hubbelllighting.com.

C. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the Drawings.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 LUMINAIRES

A. Manufacturers:
   1. Acuity Brands, Inc; : www.acuitybrands.com/#sle.
   2. Cooper Lighting, a division of Cooper Industries; _____: www.cooperindustries.com/#sle.
   3. Hubbell Lighting, Inc; : www.hubbelllighting.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Provide products that comply with requirements of NFPA 70.

C. Provide products that are listed and labeled as complying with UL 1598, where applicable.

D. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

H. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

I. LED Luminaires: Listed and labeled as complying with UL 8750.

J. Exposed Hardware: Stainless steel.

2.04 BALLASTS

A. Manufacturers:
   1. General Electric Company/GE Lighting; : www.gelighting.com/#sle.
   2. Osram Sylvania; : www.sylvania.com/#sle.
   3. Philips Lighting Electronics/Advance; : www.advance.philips.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. All Ballasts:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

2.05 LAMPS

A. Manufacturers:
   1. General Electric Company/GE Lighting; : www.gelighting.com/#sle.
   2. Osram Sylvania; : www.sylvania.com/#sle.
   3. Philips Lighting Company; : www.lighting.philips.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. All Lamps:
   1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
   2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
   3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.

4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.

2.06 POLES

A. Manufacturers:
   1. Acuity Brands, Inc; : www.acuitybrands.com/#sle.
   2. Hubbell Lighting, Inc; : www.hubbelllighting.com/#sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. All Poles:
   1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
   2. Structural Design Criteria:
      a. Comply with AASHTO LTS.
      b. Wind Load: Include effective projected area (EPA) of luminaire(s) and associated supports and accessories to be installed.
         1) Design Wind Speed: 100 miles per hour, with gust factor of 1.3.
      c. Dead Load: Include weight of proposed luminaire(s) and associated supports and accessories.
   3. Material: Steel, unless otherwise indicated.
   4. Shape: Square straight, unless otherwise indicated.
   5. Finish: Match luminaire finish, unless otherwise indicated.
   6. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.
   7. Unless otherwise indicated, provide with the following features/accessories:
      a. Top cap and metallic base cover.
      b. Handhole.
      c. Anchor bolts with leveling nuts or leveling shims.
      d. Anchor base cover.
      e. Pole-top tenon, size as required for installed luminaire or bracket.

C. Metal Poles: Provide ground lug, accessible from handhole or transformer base.

2.07 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

B. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of luminaires provided under this section.

B. Install products according to manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship) and NECA/IESNA 501 (exterior lighting).

D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

E. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

F. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

G. Install accessories furnished with each luminaire.

H. Bond products and metal accessories to branch circuit equipment grounding conductor.

I. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

3.06 CLEANING

A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

D. Just prior to Substantial Completion, replace all lamps that have failed.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 26 56 00

SECTION 27 10 05

STRUCTURED CABLING FOR VOICE AND DATA - INSIDE-PLANT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Communications system design requirements.

B. Communications pathways.

C. Copper cable and terminations.

D. Communications equipment room fittings.

E. Communications outlets.

F. Communications grounding and bonding.

G. Communications identification.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 34 - Conduit.

D. Section 26 05 37 - Boxes.

E. Section 26 05 53 - Identification for Electrical Systems: Identification products.

1.03 REFERENCE STANDARDS

A. EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment.

B. NECA/BICSI 568 - Standard for Installing Commercial Building Telecommunications Cabling.

C. NFPA 70 - National Electrical Code.

D. TIA-568-C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards.

E. TIA-569-D - Telecommunications Pathways and Spaces.

F. TIA-606 - Administration Standard for Telecommunications Infrastructure.

G. TIA-606-B - Administration Standard for Telecommunications Infrastructure.

H. TIA-607-C - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.

I. UL 444 - Communications Cables.

J. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers.

K. UL 1863 - Communications-Circuit Accessories.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.
2. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. C. Shop Drawings: Show compliance with requirements on isometric schematic diagram of network layout, showing cable routings, telecommunication closets, rack and enclosure layouts and locations, service entrance, and grounding, prepared and approved by BICSI Registered Communications Distribution Designer (RCDD)

D. Evidence of qualifications for installer. Provide manufacturer training completion certifiates for those installing systems.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

F. Field Test Reports.

G. Project Record Documents: Prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).
   1. Record actual locations of outlet boxes and distribution frames.
   2. Show as-installed color coding, pair assignment, polarization, and cross-connect layout.
   3. Identify distribution frames and equipment rooms by room number on contract drawings.

H. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of project record documents.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: At least 10 years experience manufacturing products of the type specified.

B. Installer Qualifications: A company having at least 5 years experience in the installation and testing of the type of system specified, and:
   1. Supervisors and installers factory certified by manufacturers of products to be installed.
   2. Employing Manufacturer certified installation technicians for supervision of all work.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.07 DELIVERY, STORAGE, AND HANDLING

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

B. Keep stored products clean and dry.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a 2 year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cabling and Equipment:
   1. Hubbell Premise Wiring: www.hubbell.com/hubbellpremisewiring/en
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SYSTEM DESIGN

A. Provide a complete permanent system of cabling and pathways for voice and data communications, including cables, conduits and wireways, pull wires, support structures, enclosures and cabinets, and outlets.
   1. Comply with TIA-568 (cabling) and TIA-569 (pathways), latest editions (commercial standards).
   2. Provide fixed cables and pathways that comply with NFPA 70 and TIA-607 and are UL listed or third party independent testing laboratory certified.
   3. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F at relative humidity of 0 to 95 percent, noncondensing.
   4. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.

B. System Description:
   1. Offices and Work Areas: Provide Except when otherwise noted, provide an outlet with two data ports in each work area.
   2. Classrooms: Provide outlets as indicated.
   3. Other areas: Provide outlets as indicated.

C. Main Distribution Frame (MDF): Centrally located support structure for terminating horizontal cables that extend to telecommunications outlets, functioning as point of presence to external service provider.

D. Cabling to Outlets: Specified horizontal cabling, wired in star topology to distribution frame located at center hub of star; also referred to as "links".

2.03 PATHWAYS

A. Conduit: As specified in Section 26 05 34; provide pull cords in all conduit.

B. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
   1. Products:
      a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: www.holdrite.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 COPPER CABLE AND TERMINATIONS

A. Manufacturers:
   1. Hubbell Premise Wiring: www.hubbell.com/hubbellpremisewiring/en
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Copper Horizontal Cable:
   1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568 and listed and labeled as complying with UL 444.
   2. Cable Type - Voice and Data: TIA-568 Category 6A ScTP (screened twisted pair) or F/UTP (foiled unshielded twisted pair); 23 AWG.
   3. Cable Capacity: 4-pair.
   4. Cable Applications: Use listed NFPA 70 Type CMP plenum cable unless otherwise indicated.
   5. Cable Jacket Color - See drawings
   6. Product(s):
      a. Hubbell: Nextspeed Category 6A UTP Reduced Diameter Plenum Cable Model Number C6ASPDSX: www.hubbell.com/hubbellpremisewiring/en or approved equal

C. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool; use screw connections only where specifically indicated.

D. Jacks and Connectors: Modular RJ-45, non-keyed, terminated with 110-style insulation displacement connectors (IDC); high impact thermoplastic housing; suitable for and complying with same standard as specified horizontal cable; UL 1863 listed.
   1. Performance: 750 mating cycles.
   2. Voice and Data Jacks: 8-position modular jack, color-coded for both T568A and T568B wiring configurations.
   3. Product(s):
      a. Hubbell: Nextspeed Category 6A Jacks Model Number HJU6A: www.hubbell.com/hubbellpremisewiring/en or approved equal

E. Copper Patch Cords:
   1. Description: Factory-fabricated 4-pair cable assemblies with 8-position modular connectors terminated at each end.
   2. Patch Cords for Patch Panels:
      a. Quantity: One for each pair of patch panel ports.

b. Length: One foot for patch cables to connect patch panels in racks to adjacent switches in racks.. For other patch cables, provide lengths as indicated or required for application and lenght of run. New patch panels shall be placed adjacent to switches in racks. In cases where existing patch panels are not adjacent to the applicable switch, provide appropriate minimum lenght patch cables to connect the patch panel to the applicable switch. Coordinate with Owner on placement of patch panels and switches.

3. Product(s):
   a. Hubbell: Nextspeed Category 6A Low Diameter Patch Cords Model Number HCL6AXXXX: www.hubbell.com/hubbellpremisewiring/en or approved equal

2.05 COMMUNICATIONS EQUIPMENT ROOM FITTINGS

A. Copper Cross-Connection Equipment:
   1. Manufacturers:
      a. Hubbell: NEXTSPEED Category 6A Patch Panels Model Number HPJ6A48: www.hubbell.com/hubbellpremisewiring/en or approved equal
      b. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Patch Panels for Copper Cabling: Sized to fit EIA/ECA-310 standard 19 inch wide equipment racks; 5/64 inch thick 14 gauge steel rolled-edge construction; cabling terminated on Type 110 insulation displacement connectors; printed circuit board interface.
      a. Jacks: Non-keyed RJ-45, suitable for and complying with same standard as cable to be terminated; maximum 48 ports per standard width panel.
      b. Capacity: Provide ports sufficient for cables to be terminated plus 25 percent spare.
      c. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606.
      d. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606.
      e. Provide incoming cable strain relief and routing guides on back of panel.

B. Backboards: Interior grade plywood without voids, 3/4 inch thick; UL-labeled fire-retardant.
   1. Size: As indicated on drawings.
   2. Paint white with fire retardant paint. Do not paint over UL label.

C. Equipment Racks and Cabinets: EIA/ECA-310 standard 19 inch wide component racks.
   1. Manufacturers:
      a. Hubbell: www.hubbell.com/hubbellpremisewiring/en or approved equal
      b. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Horizontal Ladder Racks: 16 Guage tubluar steel, powder coated black racks: Model HLSXX12B. Provide MFGR supplied accessories for all connectios, extensions. Provide cable radius drop accessories for all vertical cable drops. Model HLCD12.

2.06 COMMUNICATIONS OUTLETS

A. Outlet Boxes: Comply with Section 26 05 37.
   1. Provide depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.

B. Wall Plates:
   1. Comply with system design standards and UL 514C.
   2. Accepts modular jacks/inserts.
   3. Capacity:
      a. Data or Combination Voice/Data Outlets: Quantity of ports as indicated on drawings.
   4. Wall Plate Material/Finish - Flush-Mounted Outlets: Type 302 stainless steel.
   5. Product(s):
      a. Provide the following Hubbell product or as otherwise indicated on drawings: SS wallplates Model Number SSXXX. www.hubbell.com/hubbellpremisewiring/en or approved equal

2.07 GROUNDING AND BONDING COMPONENTS

A. Comply with TIA-607.

B. Comply with Section 26 05 26.

2.08 IDENTIFICATION PRODUCTS

A. Comply with TIA-606.

B. Comply with TIA-606.

C. Comply with Section 26 05 53.

2.09 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Factory test cables according to TIA-568.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Comply with latest editions and addenda of TIA-568 (cabling), TIA-569 (pathways), TIA-607 (grounding and bonding), NECA/BICSI 568, NFPA 70, and SYSTEM DESIGN as specified in PART 2.

B. Comply with Communication Service Provider requirements.

C. Grounding and Bonding: Perform in accordance with TIA-607 and NFPA 70.

D. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

3.02 INSTALLATION OF PATHWAYS

A. Install pathways with the following minimum clearances:
   1. 48 inches from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.
   2. 12 inches from power conduits and cables and panelboards.
   3. 5 inches from fluorescent and high frequency lighting fixtures.
   4. 6 inches from flues, hot water pipes, and steam pipes.

B. Conduit, in Addition to Requirements of Section 26 05 34:
   1. Arrange conduit to provide no more than the equivalent of two 90 degree bend(s) between pull points.
   2. Conduit Bends: Inside radius not less than 10 times conduit internal diameter.
   3. Arrange conduit to provide no more than 100 feet between pull points.

C. Outlet Boxes:
   1. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of telecommunications outlets provided under this section.
      a. Mounting Heights: Unless otherwise indicated, as follows:
         1) Telephone and Data Outlets: 18 inches above finished floor.
         2) Telephone Outlets for Side-Reach Wall-Mounted Telephones: 48 inches above finished floor to top of telephone.
      b. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
      c. Provide minimum of 12 horizontal separation between flush mounted outlet boxes installed on opposite sides of fire rated walls.
      d. Unless otherwise indicated, provide separate outlet boxes for line voltage and low voltage devices.
      e. Locate outlet boxes so that wall plate does not span different building finishes.
      f. Locate outlet boxes so that wall plate does not cross masonry joints.

3.03 INSTALLATION OF EQUIPMENT AND CABLING

A. Cabling:

1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
2. Do not over-cinch or crush cables.
3. Do not exceed manufacturer's recommended cable pull tension.
4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.

B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:
1. At Distribution Frames: 120 inches.
2. At Outlets - Copper: 12 inches.

C. Copper Cabling:
1. Category 5e and Above: Maintain cable geometry; do not untwist more than 1/2 inch from point of termination.
2. For 4-pair cables in conduit, do not exceed 25 pounds pull tension.
3. Use T568B wiring configuration.

D. Identification:
1. Use wire and cable markers to identify cables at each end.
2. Use manufacturer-furnished label inserts, identification labels, or engraved wallplate to identify each jack at communications outlets with unique identifier.
3. Use identification nameplate to identify cross-connection equipment, equipment racks, and cabinets.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Comply with inspection and testing requirements of specified installation standards.

C. Visual Inspection:
1. Inspect cable jackets for certification markings.
2. Inspect cable terminations for color coded labels of proper type.
3. Inspect outlet plates and patch panels for complete labels.

D. Testing - Copper Cabling and Associated Equipment:
1. Category 5e and Above Links: Perform tests for wire map, length, attenuation, NEXT, and propagation delay.

E. Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone.

END OF SECTION 27 10 05

SECTION 27 51 17
PUBLIC ADDRESS SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Amplifier and control equipment.

B. Input equipment.

C. Sound system cable.

1.02 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code.

1.03 SYSTEM DESCRIPTION

A. Public address system for voice and music.

B. Input components:
   1. Compact disc player.
   2. AM/FM tuner.
   3. Microphone.

C. Features:
   1. Interface to telephone system.
   2. One-way paging by zone.
   3. Distribution of background music.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate electrical characteristics and connection requirements. Indicate layout of equipment mounted in racks and cabinets, component interconnecting wiring, and wiring diagrams of field wiring to speakers and remote input devices.

C. Product Data: Provide data showing electrical characteristics and connection requirements for each component.

D. Test Reports: Indicate satisfactory completion of each test recommended by the manufacturer.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Manufacturer's Field Reports: Indicate that installation is complete and system performs according to specified requirements.

H. Project Record Documents: Record actual locations of speakers, control equipment, and outlets for input/output connectors.

I. Operation Data: Include instructions for adjusting, operating, and extending the system.

J. Maintenance Data: Include repair procedures and spare parts documentation.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70 and Federal Communications Commission.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience with service facilities within 100 miles of Project.

C. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented experience.

D. Installer Qualifications: Authorized installer of specified manufacturer with service facilities within 50 miles of Project.

E. Products: Listed, classified, and labeled as suitable for the purpose intended.

F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Bogen Communications, Inc: www.bogen.com.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 AMPLIFICATION AND CONTROL EQUIPMENT

A. The amplifier shall be a model Bogen M/N V60 or approved equal, rated at 60 watts RMS with manufacturer provided rack mounting hardware.

B. The amplifier shall accommodate up to 8 inputs including, but not limited to, microphone and other modular based auxiliary sources

C. Outputs shall be provided for 4- and 8-ohm speakers and for 25V and 70V distributed systems. Additional outputs shall be provided to feed a booster amp and recorder.

D. The amplifier shall be rack mountable using an accessory rack panel kit (RPK87). It shall carry the necessary safety agency listings for both the US and Canada.

E. Provide two Mic Input modules Bogen M/N MIC1S or approved equal.

2.03 COMPONENTS

A. CD Player and AM/FM Receiver:.

1. The auxiliary program source shall be a Bogen Model CDR1 CD Player with AM/FM Receiver, or equivalent.
2. The program source shall include manual tuning and auto seek control. The auto seek control shall automatically ascend (or descend) the frequency scale to the next strong frequency. It shall be possible to program up to 5 bands (FM1, FM2, FM3, AM1, AM2) with up to 6 stations each for a total of 30 stations. A preset scan control shall be provided to scroll and select from available presets. The FM section shall have a frequency range from 87.5 MHz - 108 MHz, the AM section will have a frequency range of 530 kHz - 1710 kHz. Pluggable screw terminal inputs shall be available for an AM loop antenna, a FM dipole antenna, and for speaker outputs. An F-type coax antenna connector shall also be available.
3. The CD player system shall include Browse, Repeat, Random Play, and Pause functions. The CD player shall be capable of playing CD, CD-R, or CD-RW discs (including MP3 files).
4. The CDR1 shall have a frequency response of 20 Hz - 20 kHz (< 5 dB).
5. The following controls shall be provided: Power/ Volume, Disc Eject, Mode (Radio, CD, AUX), Audio/Menu Select (Volume, Bass, Treble, Balance, Display, Seek, and Clock), Mute, Scan, Stereo/Mono, Station Store/Select, Loudness Contour, Band, and Station Select. An LCD digital readout shall be provided to show selected frequency and band (in Radio Mode) or track (in CD Mode) information.
6. The unit shall operate on 12V DC (3A) power with an included desktop-style AC power adapter. It shall be possible to drive 8-ohm loudspeakers directly from 1W per channel (Right/Left) outputs. A 50-ohm mono-summed RCA output shall also be available, in addition to stereo.
7. The unit shall be 7-1/4" W × 2-1/8" H × 9-1/4" D and shall weigh 4 lb. The unit shall mount in a standard 19-inch rack system (2 rack spaces high) with the RK78 rack mounting kit.

B. Microphone: Desk type low impedance microphone with push-to-talk switch.

1. Product: Bogen DDU250 or approved equal.
2. Microphone Preamplifier: Provide RDL EZ-MPA1 or approved equal to connect microphone to and boost signal for it to the PA amplifer.

3. Substitutions: See Section 01 60 00 - Product Requirements.

C. Ceiling Mounted Speakers
   1. All speakers shall have recessed volume control
   2. Product: Bogen M/N CSD2X2VRU or approved equal.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

D. Wall Mounted Speaker Baffles and Enclosure: Square, painted steel, with uniform perforations, and volume control
   1. All speakers shall have recessed volume control
   2. Product: Bogen M/N MB8TSLVR or approved equal.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

E. Horns: Wide dispersion indoor/outdoor horn with driver.
   1. Product: Bogen M/N SPT15A or approved equal.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

F. Telephone Interface: 600 ohm - auxiliary input.
   1. Product: Bogen M/N UTI1 Universal telephone interface compatible with Owner Provided phone system or approved equal.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 WIRE AND CABLE

A. Microphone Cord: 20 AWG stranded copper conductor, 600 volt insulation, rated 60 degrees C, two conductor shielded cable with rubber jacket. Cable shall be plenum rated.

B. Input Cable: 22 AWG copper conductor, 300 volt insulation, rated 60 degrees C, paired conductors twisted together, shielded, and covered with a PVC jacket. Cable shall be plenum rated.

C. Plenum Cable for Speaker Circuits: 22 AWG copper conductor, 300 volt insulation, rated 200 degrees C, paired conductors twisted together shielded and covered with a nonmetallic jacket; suitable for use for Class 2 circuits in air handling ducts, hollow spaces used as ducts, and plenums.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Splice cable only in accessible junction boxes or at terminal block units.

C. Make cable shields continuous at splices and connect speaker circuit shield to equipment ground only at amplifier.

D. Install input circuits in separate cables and raceways from output circuits.

E. Leave 18 inches excess cable at each termination at microphone, volume pad, speaker, and other system outlet.

F. Leave 6 feet excess cable at each termination at system cabinet

G. Provide protection for exposed cables where subject to damage.

H. Use armored cable for outside speaker circuits.

I. Support cables above accessible ceilings to keep them from resting on ceiling tiles. Use spring metal clips or plastic cable ties to support cables from structure for ceiling suspension system. Include bridle rings or drive rings.

J. Use suitable cable fittings and connectors.

K. Connect reproducers to amplifier with matching transformers.

L. Ground and bond equipment and circuits in accordance with Section 26 05 26.

M. Provide all required appropriate cabling to connect microphone preamplifier to amplifer. Cabling shall be plenum rated and run concealed in walls, above ceilings, and in conduit (if exposed).

3.02 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Provide the services of manufacturer's technical representative to prepare and start system.
   1. Include making of final wiring connections, inspection and adjusting of completed installation, and systems demonstration.
   2. Certify that installation is complete and performs according to specified requirements.

C. Measure and record sound power levels at designated locations.

3.03 ADJUSTING

A. Adjust transformer taps and volume controls for appropriate sound level.

B. Adjust devices and wall plates to be flush and level.

3.04 CLOSEOUT ACTIVITIES

A. See Section 01 79 00 - Demonstration and Training, for additional requirements.

B. Demonstration: Demonstrate operation of system to North Providence School Department's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Conduct walking tour of project.
   3. Briefly describe function, operation, and maintenance of each component.

C. Training: Train North Providence School Department's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Manufacturer's training personnel.
   4. Location: At project site.

D. Owner Requested Volume Adjustements: Provide 16 hours of contractor personnel time to adjust speaker volume as directed by Owner.

3.05 MAINTENANCE

A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide service and maintenance of public address and music system for two years from Date of Substantial Completion.

END OF SECTION 27 51 17

SECTION 27 53 13
CLOCK SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Clock system requirements.

B. Wireless clock systems and associated components:
   1. Master clock unit.
   2. Wireless secondary indicating clocks.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of clocks with potential conflicts and/or view obstructions installed under other sections or by others.
   2. Coordinate the work with other installers to provide power for clocks and equipment at required locations.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.

C. Manufacturer’s detailed field testing procedures.

D. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
   1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

E. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in North Providence School Department's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Comply with the following:
   1. NFPA 70.
   2. Applicable TIA/EIA standards.

B. Installer Qualifications: Company with minimum three years documented experience with similar clock systems and providing contract maintenance service as a regular part of their business; manufacturer's authorized installer.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.06 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum two year manufacturer warranty covering repair or replacement due to defective materials or workmanship. Warranty shall include parts and labor. Warranty shall commence on date of substantial completion.

PART 2 PRODUCTS

2.01 CLOCK SYSTEM REQUIREMENTS

A. Provide new clock system consisting of all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B, consumer application.

2.02 WIRELESS CLOCK SYSTEMS

A. Manufacturers:
   1. Wireless Clock System - Basis of Design: Sapling.
   2. Wireless Clock System - Other Acceptable Manufacturers:
      a. Bogen Communications LLC: www.bogen.com.
   3. Substitutions: See Section 01 60 00 - Product Requirements.
   4. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer.

B. Master Clock Unit:
   1. Basis of Design: Sapling M/N SMA2R0-1000-1 .
   2. Description: Microprocessor-based controller and associated accessories for maintaining time reference and correcting connected wireless secondary indicating clocks.
   3. Acceptable Time Reference Source(s): Based on Network Time Protocol (NTP) server time data obtained via local area network (LAN).
   4. Wireless Time Correction Signal Transmitter/Antenna: Compatible with wireless secondary clocks, including any existing clocks (where indicated).

C. Analog Wireless Secondary Indicating Clocks:
   1. Basis of Design: SAPLING M/N SAL-4BS-12R-0.
   2. Power Source: Battery.
   3. Time Reference Source: Synchronized with master clock unit wireless time correction signal. Each clock shall also work as a RF signal repeater, establishing a Mesh Network for time reference synchonization.
   4. Clock Face:
      a. Shape: Round.
      b. Size: 12 inch, nominal.
      c. Color: White face with black numerals and markings, unless otherwise indicated or approved by Architect.
      d. Hands: For indicating hour, minute, and second.
   5. Mounting:
      a. Single-Face Clocks: Surface.

D. Provide components as indicated or as required for extension of wireless time correction signal between master clock unit and wireless secondary indicating clocks.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that characteristics of system components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive system components.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Provide grounding and bonding in accordance with Section 26 05 26.

D. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

E. Identify system wiring and components in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Prepare and start system in accordance with manufacturer's instructions.

C. Program system parameters according to requirements of North Providence School Department.

D. Test for proper interface with other systems.

E. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.04 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of system to North Providence School Department, and correct deficiencies or make adjustments as directed.

D. Training: Train North Providence School Department's personnel on operation, adjustment, and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Manufacturer's authorized representative.
   4. Location: At project site.

3.06 PROTECTION

A. Protect installed system components from subsequent construction operations.

END OF SECTION 27 53 13

SECTION 28 10 00
ACCESS CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Access control system requirements.

B. Access control units and software.

C. Access control point peripherals, including readers and keypads.

D. Accessories.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other installers to provide suitable door hardware as required for both access control functionality and code compliance.
   2. Coordinate the placement of readers with millwork, furniture, equipment, etc. installed under other sections or by others.
   3. Coordinate the work with other installers to provide power for equipment at required locations.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Include plan views indicating locations of system components and proposed size, type, and routing of conduits and/or cables. Include elevations and details of proposed equipment arrangements. Include system interconnection schematic diagrams. Include requirements for interface with other systems.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.

D. Certify that proposed system design and components meet or exceed specified requirements.

E. Evidence of qualifications for manufacturer.

F. Evidence of qualifications for installer.

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

H. Manufacturer’s detailed field testing procedures.

I. Field quality control test reports.

J. Project Record Documents: Record actual locations of system components and installed wiring arrangements and routing.

K. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

L. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in North Providence School Department's name and registered with manufacturer.

M. Maintenance Materials: Furnish the following for North Providence School Department's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.04 QUALITY ASSURANCE

A. Comply with the following:
   1. NFPA 70.
   2. The requirements of the local authorities having jurisdiction.
   3. Applicable TIA/EIA standards.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with access control systems of similar size, type, and complexity and providing contract maintenance service as a regular part of their business; authorized manufacturer's representative.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.06 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum five year manufacturer warranty covering repair or replacement due to defective materials or workmanship. Warranty shall include parts and labor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Access Control Units - Basis of Design: Hardware: Synergis.

B. Access Control Units - Other Acceptable Manufacturers:
   1. Substitutions: See Section 01 60 00 - Product Requirements.

C. Access Control Software - Basis of Design: Genetec: www.genetec.com.

D. Access Control Software - Other Acceptable Manufacturers:
   1. Substitutions: See Section 01 60 00 - Product Requirements.

E. Readers and Keypads - Other Acceptable Manufacturers:
   1. Substitutions: See Section 01 60 00 - Product Requirements.

F. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Owners Project Manager accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

G. Source Limitations: Where possible, furnish system components and accessories produced by a single manufacturer and obtained from a single supplier.

2.02 ACCESS CONTROL SYSTEM REQUIREMENTS

A. Provide new access control system consisting of required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. System Battery Backup: Provide batteries/uninterruptible power supplies (UPS) as required for 240 minutes full operation.

C. Surge Protection:
   1. Provide surge protection for readers and door strikes/locks.

D. Access Control Points:

1. See article "ACCESS CONTROL POINT PERIPHERALS" below for device descriptions.

E. Computers Required:
   1. See article "ACCESS CONTROL UNITS AND SOFTWARE" below for product descriptions.
   2. Server(s): Genetec M/N SF-300E-T4-8T-8-I5 or approved equal
      a. Quantity: One.
      b. Location(s): Rack in MDF.
      c. SV-300E-T4 with 8TB including Security Center Omnicast™/Synergis™/Sipelia™ Intrusion Monitoring Base /AutoVu™ software (Inc. region specific power cord) (1GbE port standard, option for 2x 1Gbe ports) (Display Connections: 1x DisplayPort, 1x HDMI. Adapters for DVI, VGA sold separately): - 1 Directory for up to 32 cameras & 100 Readers (When used as a ClientWorkstation & Archiver) or 100 cameras & 100 readers (When used as an Archiver only) - 1 Access Manager-5 client/user connections (including Web clients)-Plan Manager Basic-Alarm Management-Advanced Reporting-System Partitioning-Zone Monitoring-Email support-I/O Module Support-Macro support (actual macros sold separately)-People counting-Visitor Management-Badge Designer & Import tool-Remote Security Desk-All languages supported-1 Active Directory Connection-1 Intrusion base license* (requires Security Center 5.9 or later)-1 Sipelia base license
      d. Provide appropriate and applicable rack mounting rails or shelf.
      e. Provide Genetec M/N ADV-SV300-1Y or approved equal one year software support (Genetec™ Advantage Flat Rate for 1 SV-300 system – 1 year)
      f. Peripherals required for each server:
         1) Mouse and keyboard.
         2) Monitor(s): one 24 inch monitor.

F. Interface with Other Systems:
   1. Provide products compatible with other systems requiring interface with access control system.
   2. Interface with Network video door station
      a. Provide Genetec Sipelia M/N GSC-Sipelia-1SIP-ADV or approved equal - Advanced Add-on for 1 Standard Connection providing failover and bidirectional audio and video recording (requires GSC-Sipelia-1SIP-STD and total number of STD & ADV connections must match)
      b. Provide Genetec Sipelia M/N GSC-Sipelia-1SIP-STD - 1 or approved equal - Standard Connection to an Intercom Station (requires GSC-Sipelia-Base)
      c. Provide Genetec Sipelia M/N ADV-SIP-S-1Y - or approved equal - Genetec™ Advantage for 1 Sipelia™ Standard Intercom connection - 1 Years
      d. Provide Genetec Sipelia M/N ADV-SIP-A-1Y or approved equal - Genetec™ Advantage for 1 Sipelia™ Advanced Intercom connection - 1 Years
   3. Interface with electrically operated door hardware as specified in Section 08 71 00.
      a. Capable of locking/unlocking/releasing controlled doors.
      b. Capable of receiving input from integral door hardware switches.
   4. Interface with Owner provided video surveillance system
      a. Capable of affecting camera/video operation for selected access control system events.

G. Provide products listed, classified, and labeled as suitable for the purpose intended.
   1. Access Control Units and Readers: Listed and labeled as complying with UL 294.

2.03 ACCESS CONTROL UNITS AND SOFTWARE

A. Provide access control units and software compatible with readers to be connected.

B. Provide Genetec Software M/N GSC-5.10 or approved equal

C. Provide Software Platform Genetec M/N GSC-BASE-5.10 or approved equal
   1. Genetec Security Center (GSC) Base Package - Version 5.10 which includes: 1 Directory, 5 Security Desk client connections (incl. Web Client), Plan Manager Basic, Alarm

Management, Advanced Reporting, System Partitioning, Zone Monitoring, IO Modules Support, EmailSupport, Macros Support (actual macros sold separately), Support for server virtualization, all supported languages. Must purchase a SynergisTM, OmnicastTM, or AutoVuTM base package to enable access control, video, or LPR content respectively.

D. Controllers: Provide Synergis M/N SY-LP1502 or approved equal
   1. Mercury Intelligent Controller, Linux Based, 8In/4Out/2Rd (Software Connection included)
   2. Provided control for up to 2 doors
   3. Provide Synergis M/N SY-MR52-S3 or approved qual for each additional 2 doors to be controlled. Provide a minimum of 4 of these.
      a. Mercury MR52 2-reader interface module Series 3 (8 inputs, 6 relays, PCB only, software connections included)

E. Power Supplies: Provide one Synergis M/N SY-DV4RD-E2M or approved equal
   1. Provides power for 4 doors
   2. LifeSafety Power - Genetec enclosure - 12V & 24VDC | 75W 110V|60HZ | 4 Reader | 2 Mercury or 2 Mercury and Cloudlink|E2M - Requires double stacking (2) Mercury boards with hinged standoffs to maintain full reader count with Cloudlink

F. Power Supplies: Provide one Synergis M/N SY-DV8RD-E4M or approvied equal
   1. Provides power for 8 doors
   2. LifeSafety Power - Genetec enclosure - 12V & 24VDC | 150W 110V|60HZ | 8 Reader | 4 Mercury or 3 Mercury and Cloudlink|E4M Standard - Requires double stacking (2) Mercury boards with hinged standoffs to maintain full reader count with Cloudlink

2.04 ACCESS CONTROL POINT PERIPHERALS

A. Provide devices compatible with control units and software.

B. Provide devices suitable for operation under the service conditions at the installed location.

C. Readers and Keypads:
   1. General Requirements:
      a. Provide readers compatible with credentials to be used.
      b. Color: To be selected by Architect from manufacturer's available standard colors.
      c. Contactless Smart Card Readers: HID Signo 40 Reader, wall mount, OSDP/Wiegand, Pigtail, Mobile Ready or approved equal
         1) Utilize 13.56 MHz RF communication with compatible credentials.
         2) HID Signo 40 Reader, wall mount, OSDP/Wiegand, Pigtail, Mobile Ready, BLE or approved equal
         3) Proximity Readers:
            (a) Utilize 125 kHz RF communication with compatible credentials.
         4) Bluetooth Low Energy (BLE) Readers:
            (a) Utilize 2.4 GHz RF communication with compatible mobile devices.

D. Request to Exit Devices:
   1. Pushbuttons:
   2. Motion Sensors: Passive infrared.
      a. Products:
         1) Bosch M/N DS160/DS161 or approved equal. Color to be selected by Architect
         2) Substitutions: See Section 01 60 00 - Product Requirements.

E. Door Locking Devices (Electric Strikes and Magnetic Locks): Comply with Section 08 71 00.

2.05 ACCESSORIES

A. Provide components as indicated or as required for connection of access control system to devices and other systems indicated.

B. Unless otherwise indicated, credentials to be provided by Contractor.
   1. Provide credentials compatible with readers and control units/software to be used.
   2. Credential Type: Cards or Fobs as directed by Owner..
      a. Quantity: fifty (50).

C. Unless otherwise indicated, network switches required for network connections to system components to be provided by Owner.

D. Provide cables as indicated or as required for connections between system components.
   1. Data Cables for IP Network Connections: Unshielded twisted pair (UTP), minimum Category 5e, complying with Section 27 10 05. All cabling shall be plenum rated.

E. Provide accessory racks/cabinets as indicated or as required for equipment mounting.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of system components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive system components.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to system.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install access control system in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Wiring Method: Unless otherwise indicated, use cables (not in conduit). Provide cables in conduit where exposed.
   1. Use suitable listed cables in wet locations, including underground raceways.
   2. Use suitable listed cables for vertical riser applications.
   3. Use listed plenum rated cables.
   4. Install wiring in conduit for the following:
      a. Where required for rough-in.
      b. Where required by authorities having jurisdiction.
      c. Where exposed to damage.
      d. Where installed outside the building.
      e. For exposed connections from outlet boxes to devices.
   5. Conduit: Comply with Section 26 05 34.
   6. Conceal cables unless specifically indicated to be exposed.
   7. Use power transfer hinges complying with Section 08 71 00 for concealed connections to door hardware.
   8. Route exposed cables parallel or perpendicular to building structural members and surfaces.
   9. Do not exceed manufacturer's recommended maximum cable length between components.

D. Provide grounding and bonding in accordance with Section 26 05 26.

E. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

F. Identify system wiring and components in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.

C. Prepare and start system in accordance with manufacturer's instructions.

D. Program system parameters according to requirements of North Providence School Department.

E. Test for proper interface with other systems.

F. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

G. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.04 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of system to North Providence School Department, and correct deficiencies or make adjustments as directed.

D. Training: Train North Providence School Department's personnel on operation, adjustment, and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of four hours of training.
   3. Instructor: Manufacturer's authorized representative.
   4. Location: At project site.

3.06 PROTECTION

A. Protect installed system components from subsequent construction operations.

END OF SECTION 28 10 00

SECTION 28 31 11
BUILDING INTRUSION DETECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Intrusion detection system requirements.

B. Alarm control unit.

C. Keypads.

D. Initiating devices.

E. Alarm notification appliances.

F. Accessories.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction.

B. NFPA 70 - National Electrical Code.

C. UL 609 - Local Burglar Alarm Units and Systems.

D. UL 634 - Connectors and Switches for Use with Burglar-Alarm Systems.

E. UL 636 - Holdup Alarm Units and Systems.

F. UL 639 - Intrusion-Detection Units.

G. UL 1610 - Central-Station Burglar-Alarm Units.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate compatibility of devices for the installed locations with work provided under other sections or by others.
      a. Doors and Windows: See appropriate Division 8 sections.
   2. Coordinate the placement of sensors and keypads with millwork, furniture, equipment, etc. installed under other sections or by others.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install sensors and keypads until final surface finishes and painting are complete.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.

C. Design Data: Include standby battery calculations.

D. Certify that proposed system design and components meet or exceed specified requirements.

E. Evidence of qualifications for installer.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

G. Manufacturer’s detailed field testing procedures.

H. Field quality control test reports.

I. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

J. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in North Providence School Department's name and registered with manufacturer.

K. Project Record Documents: Record actual locations of system components and installed wiring arrangements and routing.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with intrusion detection systems of similar size, type, and complexity and providing contract maintenance service as a regular part of their business; authorized representative of control unit manufacturer.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.07 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum two year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 INTRUSION DETECTION SYSTEM REQUIREMENTS

A. Provide new intrusion detection system consisting of all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Alarm Control Unit: New addressable alarm control panel located as indicated.

C. Keypads: Located as indicated.

D. Initiating Device Requirements:
   1. Protected Premises: Entire building as indicated.
   2. Provide magnetic double pole double throw contacts to monitor opened/closed position for:
      a. All perimeter doors.
      b. Designated interior doors.
   3. Provide motion detectors to detect intruder as indicated on drawings

E. Alarm Notification and Reporting Requirements:
   1. Activate alarm notification at alarm control unit and associated keypads/annunciators with appropriate zone information displayed.
   2. Activate local notification appliances.
      a. Exterior: Provide siren and strobe located as indicated on drawings.

F. Provide products listed, classified, and labeled as suitable for the purpose intended.
   1. Local Alarm Units and Systems: Listed and labeled as complying with UL 609.
   2. Central Station Alarm Units: Listed and labeled as complying with UL 1610.

G. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B, consumer application.

2.02 ALARM CONTROL UNIT

A. Manufacturers:
   1. Addressable Alarm Control Panel - Basis of Design: Honeywell.
   2. Addressable Alarm Control Panel - Other Acceptable Manufacturers:
      a. Digital Security Controls (DSC); a brand of Tyco International: www.dsc.com/#sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.
   4. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer.

B. Alarm Control Panel: Modular construction.
   1. Enclosure: Lockable; provide tamper protection.
   2. Power Supply:
      a. Primary Power: 120 VAC; provide suitable transformer/power supply; supervised for loss of AC power.
      b. Secondary Power: Standby battery; provide suitable capacity for minimum standby time required by listing requirements, applicable codes, and authority having jurisdiction, but not less than four hours; provide suitable battery charger; supervised for low battery condition; protected from accidental reversal of battery leads.

C. Alarm Initiating Circuits: Supervised.
   1. Hardwired Zones: Supports both normally closed and normally open conventional (non-addressable) initiating devices.
   2. Addressable Zones: Supports addressable initiating devices and modules using multiplexed polling loops.

D. Alarm Notification Circuits: Supervised.

E. Communications Interfaces: Supervised.
   1. Supports system reporting to central station receivers via integral interface or accessory interface modules using:
      a. Digital cellular network.

F. Keypads: Supervised.

G. Peripheral Devices: Supervised; provide tamper protection.

H. Output Relays:
   1. Relay Modules: Form C relays (normally open and normally closed); provide tamper protection.
   2. Programmable to respond to system events, according to defined scheduling, or by manual activation from keypad.

I. User Codes:
   1. Each user code to be individually assignable to any defined authority level for configurable access to system features and functions.

J. Scheduling:
   1. Provide time/calendar-based scheduling capability for automated system control.
   2. Supports open/close schedules for control of arming/disarming and reporting.
   3. Supports timed events including, but not limited to:
      a. Point bypass/unbypass.
      b. Relay activate/deactivate.
   4. Supports automatic adjustment for daylight savings time.
   5. Supports holiday schedules.

K. Event Log:
   1. Stores system events including time, date, partition, zone, and user code where applicable.
   2. Supports viewing of event log on keypads.
   3. Supports viewing of event log on remote PC.

L. Features:
   1. Capable of being programmed locally or remotely.
   2. Supports panic/duress codes.
   3. Supports user interface via:
      a. Telephone.
      b. Web browser.
      c. Mobile device.

2.03 KEYPADS

A. Manufacturer: Same as manufacturer of alarm control unit.

B. Provides interface to alarm control unit for system control and remote annunciation.

C. Provides visual notification of system status and zone information.

D. Provides audible notification to indicate system status, entry/exit delay, and alarm situations; provide separate distinguishable sounds for alarm and trouble conditions.

E. Keypad Type: Only LCD or graphic touch screen keypads are acceptable. Do not use LED keypads.

F. Graphic Touch Screen Keypads: Displays system status and zone information using plain English on graphic display; touch screen interface.

G. LCD Keypads: Displays system status and zone information using plain English on alphanumeric display; illuminated keys.

H. Keypad Color: To be selected by Architect from manufacturer's available standard colors.

2.04 INITIATING DEVICES

A. Manufacturers: Same as manufacturer of alarm control units where possible.

B. General Requirements:
   1. Provide devices suitable for intended application and location to be installed.
   2. Outdoor Units: Weather resistant, suitable for outdoor use.
   3. Addressable Systems:
      a. Addressable Devices: Individually identifiable by control unit.
      b. Provide suitable addressable modules for connection to conventional (non-addressable) devices and other components that provide a dry closure output.

C. Contacts:
   1. Listed and labeled as complying with UL 634.
   2. Magnetic Contacts: Encapsulated reed switch(es) and separate magnet; designed to monitor opened/closed position of doors or windows.
      a. Use standard security contacts (not balanced magnetic type) unless otherwise indicated.
   3. Contact Color: To be selected by Architect from manufacturer's available standard colors.

D. Motion Detectors:
   1. Listed and labeled as complying with UL 639.
   2. Passive Infrared (PIR) Motion Detectors: Designed to detect intruder by sensing movement of thermal energy between zones.

E. Hold-Up/Panic Switches:
   1. Listed and labeled as complying with UL 634 or UL 636 as applicable.
   2. Hold-Up/Panic Buttons: Manual push button operation.

2.05 ALARM NOTIFICATION APPLIANCES

A. Manufacturers: Same as manufacturer of alarm control units where possible.

B. Provide alarm notification appliances suitable for connection to control unit outputs.

C. Outdoor Units: Weather resistant, suitable for outdoor use.

D. Sirens: Speaker with self-contained siren driver.

1. Minimum Sound Output:
    a. Indoor Units: 100 dB at 3 feet (1 m).
    b. Outdoor Units: 110 dB at 3 feet (1 m).
2. Provide tamper switches for outdoor units.

E. Strobes:
1. Color: Clear.
2. Provide tamper switches for outdoor units.

2.06 ACCESSORIES

A. Provide components as indicated or as required for connection of alarm control unit to devices and other systems indicated.

B. Provide cables as indicated or as required for connections between system components.

C. Provide end-of-line resistors (EOLR) as required for supervision of hardwired zones.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of system components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive system components.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to system.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Wiring Method: Unless otherwise indicated, use cables (not in conduit).
1. Use listed plenum rated cables in spaces used for environmental air.
2. Install wiring in conduit where required for rough-in, where required by authority having jurisdiction, and where exposed to damage.
3. Conduit: Comply with Section 26 05 34.
4. Conceal all cables unless specifically indicated to be exposed.
5. Route exposed cables parallel or perpendicular to building structural members and surfaces.

D. Provide grounding and bonding in accordance with Section 26 05 26.

E. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

F. Identify system wiring and components in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.

C. Prepare and start system in accordance with manufacturer's instructions.

D. Inspection and testing to include, at a minimum:
1. Test each initiating device for proper response by alarm control unit.
2. Test for proper operation of alarm notification appliances.
3. Test for proper operation of output relays.
4. Test for proper operation of communication interfaces and central station reporting.

5. Test for proper interface with other systems.

E. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.04 ADJUSTING

A. Program system parameters according to requirements of North Providence School Department.

3.05 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. Demonstration: Demonstrate proper operation of system to North Providence School Department, and correct deficiencies or make adjustments as directed.

C. Training: Train North Providence School Department's personnel on operation, adjustment, and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of four hours of training.
   3. Instructor: Manufacturer's authorized representative.
   4. Location: At project site.

3.07 PROTECTION

A. Protect installed system components from subsequent construction operations.

END OF SECTION 28 31 11

SECTION 28 46 00
FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire alarm system design and installation, including all components, wiring, and conduit.

B. Maintenance of fire alarm system under contract for specified warranty period.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Evidence of designer qualifications.

C. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
   1. Copy (if any) of list of data required by authority having jurisdiction.
   2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
   3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
   4. System zone boundaries and interfaces to fire safety systems.
   5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
   6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
   7. List of all devices on each signaling line circuit, with spare capacity indicated.
   8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
   9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
   10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
   11. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
   12. Certification by Owners Project Manager that the system design complies with Contract Documents.

D. Evidence of installer qualifications.

E. Evidence of maintenance contractor qualifications, if different from installer.

F. Inspection and Test Reports:
   1. Submit inspection and test plan prior to closeout demonstration.
   2. Submit documentation of satisfactory inspections and tests.
   3. Submit NFPA 72 "Inspection and Test Form," filled out.

G. Operating and Maintenance Data: See Section 01 78 00 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
   1. Complete set of specified design documents, as approved by authority having jurisdiction.
   2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
   3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
   4. List of recommended spare parts, tools, and instruments for testing.
   5. Replacement parts list with current prices, and source of supply.
   6. Detailed troubleshooting guide and large scale input/output matrix.

7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to North Providence School Department.
8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

H. Project Record Documents: See Section 01 78 00 for additional requirements; have one set available during closeout demonstration:
1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
2. "As installed" wiring and schematic diagrams, with final terminal identifications.
3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

I. Closeout Documents:
1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
3. Maintenance contract.

1.03 QUALITY ASSURANCE

A. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Owners Project Manager, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.

B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.

C. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

1.04 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.

C. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Alarm Control Units and Accessories:
1. Honeywell Security & Fire Solutions/Notifier; _____: www.notifier.com/#sle.
2. Siemens Building Technologies, Inc; _____: www.usa.siemens.com/#sle.
3. Simplex, a brand of Johnson Controls; _____: www.simplex-fire.com/#sle.
4. Provide control units made by the same manufacturer.

B. Substitutions: See Section 01 60 00 - Product Requirements.

1. For other acceptable manufacturers of control units specified, submit product data showing equivalent features and compliance with Contract Documents.

2.02 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
   1. Provide all components necessary, regardless of whether shown in Contract Documents or not.
   2. Protected Premises: Entire building shown on drawings.
   3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
      a. ADA Standards.
      b. The requirements of the State Fire Marshal.
      c. The requirements of the local authority having jurisdiction.
      d. Applicable local codes.
      e. Contract Documents (drawings and specifications).
      f. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
   4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
   5. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
   6. Fire Command Center: Location indicated on drawings.
   7. Fire Alarm Control Unit: New, located at fire command center.

B. Supervising Stations and Fire Department Connections:
   1. Public Fire Department Notification: By on-premises supervising station.

C. Circuits:
   1. Initiating Device Circuits (IDC): Class A, Style D.
   2. Signaling Line Circuits (SLC) Within Single Building: Class A, Style 5.
   3. Notification Appliance Circuits (NAC): Class A, Style Z.

D. Spare Capacity:
   1. Initiating Device Circuits: Minimum 25 percent spare capacity.
   2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
   3. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

E. Power Sources:
   1. Primary: Dedicated branch circuits of the facility power distribution system.
   2. Secondary: Storage batteries.
   3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
   4. Each Computer System: Provide uninterruptible power supply (UPS).

2.03 FIRE SAFETY SYSTEMS INTERFACES

A. Doors:
   1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 08 71 00.
   2. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from. Refer to Section 08 71 00.

2.04 COMPONENTS

A. General:

1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.

C. Addressable Modules:
1. Provide addressable modules suitable for connection to fire alarm control unit signaling line circuits.
2. Unless otherwise indicated, use addressable modules only in clean, dry, indoor, nonhazardous locations.
3. Monitor Modules: Unless devices are explicitly permitted to be connected together as zone, provide separate addressable monitor module for each conventional dry-contact input device in order to be individually identifiable by addressable fire alarm control unit.
4. Control Modules: Provide as indicated or as required for selective control of notification appliances.
5. Releasing Control Modules: Provide as indicated or as required for control of listed solenoids in releasing applications.
6. Relay Modules: Provide as indicated or as required to perform necessary functions via dry-contact interface. Where load exceeds module contact rating, provide accessory power isolation relays suitable for load as required.
7. Signaling Line Circuit (SLC) Isolating Modules: Provide as indicated or as required to automatically isolate short circuits on connected sections of SLC loops and allow other sections to continue to function normally. Provide automatic reset upon correction of short circuit.

D. Initiating Devices:
1. Addressable Systems:
a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.
b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.

E. Circuit Conductors: Copper or optical fiber; provide 200 feet extra; color code and label.

F. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.

G. Locks and Keys: Deliver keys to North Providence School Department.
1. Provide the same standard lock and key for each key operated switch and lockable panel and cabinet; provide 5 keys of each type

H. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
2. Provide one for each control unit where operations are to be performed.
3. Obtain approval of North Providence School Department prior to mounting; mount in location acceptable to North Providence School Department.
4. Provide extra copy with operation and maintenance data submittal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.

B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

C. Obtain North Providence School Department's approval of locations of devices, before installation.

D. Install instruction cards and labels.

3.02 INSPECTION AND TESTING FOR COMPLETION

A. Notify North Providence School Department 7 days prior to beginning completion inspections and tests.

B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

E. Provide all tools, software, and supplies required to accomplish inspection and testing.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

H. Diagnostic Period: After successful completion of inspections and tests, Operate system in normal mode for at least 14 days without any system or equipment malfunctions.
   1. Record all system operations and malfunctions.
   2. If a malfunction occurs, start diagnostic period over after correction of malfunction.
   3. North Providence School Department will provide attendant operator personnel during diagnostic period; schedule training to allow North Providence School Department personnel to perform normal duties.
   4. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

3.03 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to North Providence School Department.
   1. Be prepared to conduct any of the required tests.
   2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
   3. Have authorized technical representative of control unit manufacturer present during demonstration.
   4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
   5. Repeat demonstration until successful.

3.04 MAINTENANCE

A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide to North Providence School Department, at no extra cost, a written maintenance contract for entire manufacturer's warranty period, to include the work described below.

C. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
   1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
   2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
   3. Record keeping required by NFPA 72 and authorities having jurisdiction.

D. Provide trouble call-back service upon notification by North Providence School Department:
   1. Provide on-site response within 2 hours of notification.

2. Include allowance for call-back service during normal working hours at no extra cost to North Providence School Department.
3. North Providence School Department will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

E. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

F. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to North Providence School Department's representative upon completion of site visit.

G. Comply with North Providence School Department's requirements for access to facility and security.

END OF SECTION 28 46 00

SECTION 31 22 00
GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removal of topsoil.

B. Rough grading the site for site structures.

1.02 RELATED REQUIREMENTS

A. Section 31 23 16 - Excavation.

B. Section 31 23 16.13 - Trenching: Trenching and backfilling for utilities.

C. Section 31 23 23 - Fill: Filling and compaction.

D. Section 32 92 19 - Seeding: Finish ground cover.

PART 2 PRODUCTS

2.01 MATERIALS

A. Topsoil: See Section 31 23 23 - Fill.

PART 3 EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Provide temporary means and methods to remove all standing or ponding water from areas prior to grading.

D. Protect site features to remain, including but not limited to existing structures, fences, sidewalks, paving, and curbs, from damage by grading equipment and vehicular traffic.

3.02 ROUGH GRADING

A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.

B. Do not remove topsoil when wet.

C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.

D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.

E. When excavating through roots, perform work by hand and cut roots with sharp axe.

F. See Section 31 23 23 - Fill, for filling procedures.

G. Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key fill material to slope for firm bearing.

H. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

I. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack surface water control.

3.03 SOIL REMOVAL

A. Stockpile topsoil to be re-used on site; remove remainder from site.

B. Stockpiles: Use areas designated on site; pile depth not to exceed 8 feet; protect from erosion.

3.04 REPAIR AND RESTORATION

A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

3.05 FIELD QUALITY CONTROL

A. See Section 31 23 23 - Fill, for compaction density testing.

3.06 CLEANING

A. Remove unused stockpiled topsoil. Grade stockpile area to prevent standing water.

B. Leave site clean and raked, ready to receive landscaping.

END OF SECTION 31 22 00

SECTION 31 23 16
EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavating for footings, slabs-on-grade, paving, site structures, and utilities within the building.

B. Trenching for utilities outside the building to utility main connections.

C. Temporary excavation support and protection systems.

1.02 RELATED REQUIREMENTS

A. Section 31 22 00 - Grading: Grading.

B. Section 31 23 16.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.

C. Section 31 23 23 - Fill: Fill materials, backfilling, and compacting.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards.

PART 2 PRODUCTS

2.01 MATERIALS

A. Bedding and Fill to Correct Over-Excavation:
   1. See Section 31 23 23- Fill, for bedding and corrective fill materials at general excavations.
   2. See Section 31 23 16.13 - Trenching, for bedding and corrective fill materials at utility trenches.

B. Underground Warning Tapes:

PART 3 EXECUTION

3.01 EXAMINATION

A. Survey existing adjacent structures and improvements and establish exact elevations at fixed points to act as benchmarks.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Locate, identify, and protect utilities that remain and protect from damage.

C. Protect existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

D. Grade top perimeter of excavation to prevent surface water from draining into excavation. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by Architect.

3.03 TEMPORARY EXCAVATION SUPPORT AND PROTECTION

A. Excavation Safety: Comply with OSHA92s Excavation Standard, 29 CFR 1926, Subpart P.

3.04 EXCAVATING

A. Excavate to accommodate new structures and construction operations.

B. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

C. Do not interfere with 45 degree bearing splay of foundations.

D. Provide temporary means and methods, as required, to remove all water from excavations until directed by Architect. Remove and replace soils deemed suitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.05 SUBGRADE PREPARATION

A. See Section 31 23 23 - Fill, for subgrade preparation at general excavations.

B. See Section 31 23 16.13 - Trenching, for subgrade preparation at utility trenches.

3.06 FILLING AND BACKFILLING

A. Do not fill or backfill until all debris, water, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from excavation.

B. Install underground warning tape at buried utilities.

C. See Section 31 23 23 - Fill, for fill, backfill, and compaction requirements at general excavations.

D. See Section 31 23 16.13 - Trenching, for fill, backfill, and compaction requirements at utility trenches.

E. See Section 31 22 00 - Grading, for rough and final grading and topsoil replacement requirements.

3.07 REPAIR

A. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 31 23 23 - Fill.

3.08 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.

B. Provide for visual inspection of load-bearing excavated surfaces by Authority having jurisdiction before placement of foundations.

3.09 CLEANING

A. Stockpile excavated material to be re-used in area designated on site in accordance with Section 31 22 00 - Grading.

B. Remove excavated material that is unsuitable for re-use from site.

C. Remove excess excavated material from site.

3.10 PROTECTION

A. Divert surface flow from rains or water discharges from the excavation.

B. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.

C. Protect open excavations from rainfall, runoff, freezing groundwater, or excessive drying so as to maintain foundation subgrade in satisfactory, undisturbed condition.

D. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

E. Keep excavations free of standing water and completely free of water during concrete placement.

END OF SECTION 31 23 16

SECTION 31 23 16.13
TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Backfilling and compacting for utilities outside the building to utility main connections.

1.02 RELATED REQUIREMENTS

A. Section 31 22 00 - Grading: Site grading.

B. Section 31 23 16 - Excavation: Building and foundation excavating.

C. Section 31 23 23 - Fill: Backfilling at building and foundations.

1.03 REFERENCE STANDARDS

A. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. General Fill: Subsoil excavated on-site.
   1. Graded.
   2. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
   3. Conforming to ASTM D2487 Group Symbol CL.

B. Structural Fill: Subsoil excavated on-site.
   1. Graded.
   2. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
   3. Conforming to ASTM D2487 Group Symbol CL.

C. Granular Fill: Coarse aggregate, conforming to State of Delaware Highway Department standard.

D. Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.

E. Topsoil: See Section 31 22 00.

2.02 ACCESSORIES

A. Geotextile Fabric: Non-biodegradable, woven fabric for sub-surface drainage. Class 2 (AASHTO M288-06 (2011))

B. Detectable Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench marks and intended elevations for the work are as indicated.

3.02 TRENCHING

A. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

B. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.

C. Do not interfere with 45 degree bearing splay of foundations.

D. Cut trenches wide enough to allow inspection of installed utilities.

E. Hand trim excavations. Remove loose matter.

F. Remove excavated material that is unsuitable for re-use from site.

G. Remove excess excavated material from site.

H. Provide temporary means and methods, as required, to remove all water from trenching until directed by the Architect. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

I. Determine the prevailing groundwater level prior to trenching. If the proposed trench extends less than 1 foot into the prevailing groundwater, control groundwater intrusion with perimeter drains routed to sump pumps, or as directed by the Architect.

3.03 PREPARATION FOR UTILITY PLACEMENT

A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.04 BACKFILLING

A. Backfill to contours and elevations indicated using unfrozen materials.

B. Employ a placement method that does not disturb or damage other work.

C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

D. Maintain optimum moisture content of fill materials to attain required compaction density.

E. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

F. Correct areas that are over-excavated.
   1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.

G. Compaction Density Unless Otherwise Specified or Indicated:

H. Reshape and re-compact fills subjected to vehicular traffic.

3.05 BEDDING AND FILL AT SPECIFIC LOCATIONS

A. Utility Piping:
   1. Bedding: Use general fill.
   2. Cover with general fill.
   3. Fill up to subgrade with general fill. Fill with topsoil at top 6 inches..
   4. Compact in maximum 8 inch lifts to 95 percent of maximum dry density.

3.06 DETECTABLE PIPE MARKERS

A. Install detectable underground plastic pipe marker tape above HDPE, PVC and concrete pipe at a depth of 14" to 24" below surface.

3.07 TOLERANCES

A. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.

3.08 CLEANING

A. Leave unused materials in a neat, compact stockpile.

B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION 31 23 16.13

SECTION 31 23 19
DEWATERING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

B. DNREC Standards and Specifications for Soil Erosion and Sediment Control.

1.02 SUMMARY

A. Section includes construction dewatering.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review condition of site to be dewatered including coordination with temporary erosion-control measures and temporary controls and protections.
   3. Review proposed site clearing and excavations.
   4. Review existing utilities and subsurface conditions.
   5. Review observation and monitoring of dewatering system.

1.04 ACTION SUBMITTALS

A. Shop Drawings: For dewatering system, prepared by or under the supervision of a qualified professional engineer.
   1. Include plans, elevations, sections, and details.
   2. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.
   3. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
   4. Include written plan for dewatering operations including sequence of well and well-point placement coordinated with excavation shoring and bracings and control procedures to be adopted if dewatering problems arise.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and professional engineer.

B. Field quality-control reports.

C. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by dewatering operations. Submit before Work begins.

D. Record Drawings: Identify locations and depths of capped wells and well points and other abandoned-in-place dewatering equipment.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in design of dewatering systems and dewatering work.

1.07 FIELD CONDITIONS

A. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for dewatering according to the performance requirements.

B. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
   1. Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer.
   2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, prevention of flooding in excavation, and prevention of damage to subgrades and permanent structures.
   3. Prevent surface water from entering excavations by grading, dikes, or other means.
   4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
   5. Remove dewatering system when no longer required for construction.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with water- and debris-disposal regulations of authorities having jurisdiction.

PART 3 EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
   1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.
   2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Provide temporary grading to facilitate dewatering and control of surface water.

D. Protect and maintain temporary erosion and sedimentation controls.

3.02 INSTALLATION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
   1. Space well points or wells at intervals required to provide sufficient dewatering.
   2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

B. Place dewatering system into operation to lower water to specified levels before excavating below ground-water level.

C. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

D. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails.

3.03 OPERATION

A. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.

B. Operate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
   1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
   2. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
   3. Maintain piezometric water level a minimum of [24 inches (600 mm)] [60 inches (1500 mm)] <Insert dimension> below bottom of excavation.

C. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

D. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches (900 mm) below overlying construction.

3.04 FIELD QUALITY CONTROL

A. Observation Wells: Provide observation wells or piezometers, take measurements, and maintain at least the minimum number indicated; additional observation wells may be required by authorities having jurisdiction.
   1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
   2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.
   3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

B. Survey-Work Benchmarks: Resurvey benchmarks [regularly] [monthly] <Insert time period> during dewatering and maintain an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

C. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

D. Prepare reports of observations.

3.05 PROTECTION

A. Protect and maintain dewatering system during dewatering operations.

B. Promptly repair damages to adjacent facilities caused by dewatering.

END OF SECTION 31 23 19

SECTION 31 23 23
FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Backfilling and compacting for utilities outside the building to utility main connections.

1.02 RELATED REQUIREMENTS

A. Section 31 22 00 - Grading: Removal and handling of soil to be re-used.

B. Section 31 23 16 - Excavation: Removal and handling of soil to be re-used.

C. Section 31 23 16.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.

1.03 DEFINITIONS

A. Finish Grade Elevations: Match existing.

1.04 REFERENCE STANDARDS

A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18 in.) Drop.

B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

C. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.

D. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)).

E. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

F. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

G. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Compaction Density Test Reports.

1.06 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. General Fill: Subsoil excavated on-site.
   1. Graded.
   2. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.

B. Granular Fill: Coarse aggregate, conforming to State of Delaware Highway Department standard.

C. Sand: Conforming to State of Delaware Highway Department standard.

D. Topsoil: See Section 31 22 00 - Grading.

2.02 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of soil material.

B. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.01 EXAMINATION

A. Identify required lines, levels, contours, and datum locations.

B. See Section 31 22 00 - Grading for additional requirements.

C. Verify areas to be filled are not compromised with surface or ground water.

3.02 PREPARATION

A. Scarify subgrade surface to a depth of 6 inches to identify soft spots.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

A. Fill to contours and elevations indicated using unfrozen materials.

B. Employ a placement method that does not disturb or damage other work.

C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

D. Maintain optimum moisture content of fill materials to attain required compaction density.

E. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

F. Correct areas that are over-excavated.
   1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.

G. Compaction Density Unless Otherwise Specified or Indicated:

H. Reshape and re-compact fills subjected to vehicular traffic.

I. Maintain temporary means and methods, as required, to remove all water while fill is being placed as required, or until directed by the Architect. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.04 FILL AT SPECIFIC LOCATIONS

A. Over Buried Utility Piping, Conduits, and Duct Bank in Trenches :
   1. Cover with general fill.
   2. Fill up to subgrade elevation.
   3. Compact in maximum 8 inch lifts to 95 percent of maximum dry density.

B. Under Pavers Set on Sand Leveling Bed:
   1. Use granular fill.
   2. Fill up to bottom of sand leveling bed.
   3. Compact to 95 percent of maximum dry density.
   4. See unit pavers section for leveling bed placement.

3.05 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.

B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.

C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor"), ASTM D1557 ("modified Proctor"), or AASHTO T 180.

D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

3.06 CLEANING

A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION 31 23 23

SECTION 31 31 16
TERMITE CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Chemical soil treatment.

1.02 REFERENCE STANDARDS

A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.

C. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing this type of work and:
   1. Having minimum of three (3) years documented experience.
   2. Approved by manufacturer of treatment materials.
   3. Licensed in Rhode Island.

PART 2 PRODUCTS

2.01 CHEMICAL SOIL TREATMENT

A. Toxicant Chemical: EPA (Title 7, United States Code, 136 through 136y) approved; synthetically color dyed to permit visual identification of treated soil.

B. Diluent: Recommended by toxicant manufacturer.

C. Manufacturers:
   1. Bayer Environmental Science Corp: www.backedbybayer.com/pest-management/#sle.
   2. FMC Professional Solutions: www.fmcprosolutions.com/#sle.
   3. Syngenta Professional Products: www.syngentaprofessionalproducts.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.

B. Verify final grading is complete.

3.02 APPLICATION - CHEMICAL TREATMENT

A. Comply with requirements of U.S. EPA and applicable state and local codes.

B. Spray apply toxicant in accordance with manufacturer's instructions.

C. Apply toxicant at following locations:
   1. Under Slabs-on-Grade.
   2. At Both Sides of Foundation Surface.

D. Under slabs, apply toxicant immediately prior to installation of vapor barrier.

E. At foundation walls, apply toxicant immediately prior to finish grading work outside foundations.

F. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.

G. Re-treat disturbed treated soil with same toxicant as original treatment.

H. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.03 PROTECTION

A. Do not permit soil grading over treated work.

END OF SECTION 31 31 16

SECTION 32 11 23
AGGREGATE BASE COURSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aggregate base course.

1.02 RELATED REQUIREMENTS

A. Section 31 22 00 - Grading: Preparation of site for base course.

B. Section 31 23 23 - Fill: Compacted fill under base course.

C. Section 32 13 13 - Concrete Paving: Finish concrete surface course.

1.03 REFERENCE STANDARDS

A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Materials Sources: Submit name of imported materials source.

1.05 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When aggregate materials need to be stored on site, locate where directed by North Providence School Department.

C. Aggregate Storage, General:
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.01 MATERIALS

A. Coarse Aggregate : Pit run washed stone; free of shale, clay, friable material and debris.
   1. Graded in accordance with ASTM C136, within the following limits:
      a. 3/4 inch sieve: 95 to 100 percent passing.

2.02 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of aggregate materials.

B. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench marks and intended elevations for the work are as indicated.

B. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.02 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place aggregate on soft, muddy, or frozen surfaces.

3.03 INSTALLATION

A. Under Portland Cement Concrete Paving:
   1. Place coarse aggregate to a total compacted thickness of 4 inches.
   2. Compact to 95 percent of maximum dry density.

B. Level and contour surfaces to elevations and gradients indicated.

C. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

D. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.04 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

3.05 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.

B. Proof roll compacted aggregate at surfaces that will be under slabs-on-grade.

3.06 CLEANING

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION 32 11 23

SECTION 32 12 16
ASPHALT PAVING

PART 1 GENERAL

1.01 QUALITY ASSURANCE

A. Perform Work in accordance with State of _____ Highways standard.

B. Mixing Plant: Complying with State of _____ Highways standard.

C. Obtain materials from same source throughout.

PART 2 PRODUCTS

2.01 MATERIALS

A. Asphalt Cement: ASTM D946.

B. Aggregate for Base Course: In accordance with State of _____ Highways standards.

C. Aggregate for Binder Course: In accordance with State of _____ Highways standards.

D. Aggregate for Wearing Course: In accordance with State of _____ Highways standards.

E. Fine Aggregate: In accordance with State of _____ Highways standards.

F. Mineral Filler: Finely ground particles of limestone, hydrated lime or other mineral dust, free of foreign matter.

G. Fiber Reinforcement: Synthetic fibers shown to have long-term resistance to deterioration when in contact with alkalis and moisture; 1/2 inch length.

H. Primer: In accordance with State of _____ Highways standards.

I. Tack Coat: Homogeneous, medium curing, liquid asphalt.

J. Seal Coat: AI MS-19, sand type. Provide _____ manufactured by _____.

2.02 ASPHALT PAVING MIXES AND MIX DESIGN

A. Asphalt Base Course: 3.0 to 6 percent of asphalt cement by weight in mixture in accordance with AI MS-2.

B. Asphalt Binder Course: 4.5 to 6 percent of asphalt cement by weight in mixture in accordance with AI ____.

C. Asphalt Wearing Course: 5 to 7 percent of asphalt cement by weight in mixture in accordance with AI MS-2.

PART 3 EXECUTION

3.01 AGGREGATE BASE COURSE

A. Place and compact aggregate base course.

3.02 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

A. Place asphalt binder course within 24 hours of applying primer or tack coat.

B. Place asphalt wearing course within two hours of placing and compacting binder course.

C. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

D. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

END OF SECTION 32 12 16

SECTION 32 13 13
CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete sidewalks.

1.02 RELATED REQUIREMENTS

A. Section 03 10 00 - Concrete Forming and Accessories.

B. Section 03 20 00 - Concrete Reinforcing.

C. Section 07 90 05 - Joint Sealers: Sealant for joints.

D. Section 31 22 00 - Grading: Preparation of site for paving.

1.03 REFERENCE STANDARDS

A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.

B. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.

C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

D. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

E. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.

F. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

G. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

H. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on joint filler, admixtures, and curing compound.

PART 2 PRODUCTS

2.01 PAVING ASSEMBLIES

A. Concrete Sidewalks: 4,000 psi 28 day concrete, 4 inches thick.

2.02 FORM MATERIALS

A. Wood form material, profiled to suit conditions.

B. Joint Filler: Preformed; non-extruding bituminous type (ASTM D1751) or sponge rubber or cork (ASTM D1752).
   1. Thickness: 1/2 inch.

2.03 REINFORCEMENT

A. Reinforcing Steel and Welded Wire Reinforcement: Types specified in Section 03 20 00.

2.04 CONCRETE MATERIALS

A. Obtain cementitious materials from same source throughout.

B. Concrete Materials: As specified in Section 03 30 00.

C. Fiber Reinforcement: Synthetic fibers shown to have long-term resistance to deterioration when in contact with alkalis and moisture; 1/2 inch length.

2.05 ACCESSORIES

A. Curing Compound: ASTM C309, Type 1, Class A.

B. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

3.02 SUBBASE

A. See Section 32 11 23 - Aggregate Base Courses, for construction of base course for work of this Section.

3.03 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

3.04 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.05 REINFORCEMENT

A. Place reinforcement at top of slabs-on-grade.

B. Interrupt reinforcement at contraction joints.

C. Place dowels to achieve pavement and curb alignment as detailed.

3.06 PLACING CONCRETE

A. Do not place concrete when base surface is wet.

B. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.

C. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

3.07 JOINTS

A. Align sidewalk joints.

B. Place 1/2 inch wide expansion joints at 20 foot intervals and to separate paving from vertical surfaces and other components.
   1. Form joints with joint filler extending from bottom of pavement to within 1/2 inch of finished surface.
   2. Secure to resist movement by wet concrete.

C. Provide scored joints:
   1. At 3 feet intervals.
   2. Between new sidewalk and existing sidewalk.

3.08 FINISHING

A. Sidewalk Paving: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/4 inch radius.

3.09 JOINT SEALING

A. See Section for joint sealer requirements.

3.10 TOLERANCES

A. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.

B. Maximum Variation From True Position: 1/4 inch.

3.11 FIELD QUALITY CONTROL

A. Compressive Strength Tests: ASTM C39/C39M. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd or less of each class of concrete placed.

B. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.12 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Do not permit pedestrian traffic over pavement until 75 percent design strength of concrete has been achieved.

END OF SECTION 32 13 13

SECTION 32 17 23
PAVEMENT MARKINGS

PART 1 GENERAL

PART 2 PRODUCTS

2.01 PAINTED PAVEMENT MARKINGS

A. Painted Pavement Markings: As indicated on drawings.
   1. Marking Paint: In accordance with AASHTO MP 24.
   2. Reflective Glass Beads: Type 1, in accordance with AASHTO M 247.
   3. Obliterating Paint: Type I, in accordance with AASHTO MP 24.

2.02 RAISED PAVEMENT MARKINGS

A. Surface Reflectors: Bidirectional, visible to approaching traffic; capable of withstanding pavement-rated loading.
   1. Housing: Plastic, yellow.
   2. Lens: Prismatic, acrylic, yellow.

B. Delineator Posts: All-direction visibility, reboundable.
   1. Upright:
      a. Material: Polypropylene.
      b. Height: 24 inches (610 mm).
      c. Width: 3 inches (76 mm).
   2. Base:
      a. Material: Acrylonitrile butadiene styrene.
   3. Mounting Hardware: Stainless steel.
   4. Mounting Adhesive: Type I, in accordance with AASHTO M 237.

2.03 PLASTIC PAVEMENT MARKINGS

A. Plastic Pavement Markings: Preformed, uniform, smooth edges.
   1. Marking Tape: Vinyl, with retroreflective beads, in accordance with ASTM D4505.
      a. Class: Class 1, in accordance with ASTM D4505.
      b. Color: Yellow.
   2. Thermoplastic Markings: Alkyd, in accordance with AASHTO M 249.
      a. Color: Yellow.
      b. Reflective Glass Beads: Type 1, in accordance with AASHTO M 247.

PART 3 EXECUTION

3.01 INSTALLATION

A. General:
   1. Position pavement markings as indicated on drawings.
   2. Field location adjustments require approval of Architect.

B. Painted Pavement Markings:
   1. Apply in accordance with manufacturer's instructions.
   2. Obliterating Paint: Apply as necessary to cover existing markings completely.
   3. Marking Paint: Apply uniformly, with sharp edges.
      a. Applications: One coat.
      b. Wet Film Thickness: 0.015 inch, minimum.
      c. Glass Beads: Apply directly to paint, 10 second lag time, 6 lbs/gal of paint, uniform thickness and coverage.

C. Raised Pavement Markings:
   1. Install in accordance with manufacturer's instructions in manner necessary to maintain manufacturer's warranty.
   2. Surface Reflectors:
      a. Cut pavement and remove depth equal to height of reflector.

b. Partially fill area with road marker epoxy adhesive.
c. Press reflector into adhesive and apply pressure.

3. Delineator Posts:
   a. Base: Drill anchor holes into pavement. Place anchor sleeves into anchor holes flush with pavement surface. Screw anchor bolts through base holes into anchor sleeves.
      1) Apply mounting adhesive to base underside before anchoring.
   b. Upright: Attach post to base before anchoring in place.

D. Plastic Pavement Markings:
   1. Install in accordance with manufacturer's instructions in manner necessary to maintain manufacturer's warranty.
   2. Marking Tape: Place tape on pavement smooth and without wrinkles. 1/4 inch (6 mm) maximum gap between adjacent pieces. Immediately apply uniform pressure until firmly adhered.
   3. Thermoplastic Markings: Preheat pavement surface to 275 degrees F (135 degrees C). Place markings on pavement smooth and without wrinkles. 1/4 inch (6 mm) maximum gap between adjacent markings. Uniformly heat markings between 400 degrees F (204 degrees C) to 440 degrees F (227 degrees C). Do not overheat, scorch, or disperse embedded glass beads.

END OF SECTION 32 17 23

SECTION 32 18 13
SYNTHETIC GRASS SURFACING

PART 1 GENERAL

PART 2 PRODUCTS

2.01 SYNTHETIC GRASS SURFACING

A. Synthetic Grass Carpet: Yarn fibers tufted through and adhered to porous fiber backing.
   1. Permeability: 10 inches (254 mm) of water per hour, minimum.
   2. Lead Content: 100 ppm, maximum, in accordance with ASTM F2765.
   3. Roll: 10 feet (3 m) feet wide, minimum.
   4. Noncombustible: Pass ASTM D2859 for flammability.
   5. Field Graphics:

B. Synthetic Grass Infill: 2 pounds per square foot (10 ksm), minimum at 50 to 50 percent granule to synthetic sand.

C. Shock Absorbing Course:
   1. Impact Mats, Prefabricated Cushion: ASTM D1056; factory-fabricated resilient sheet or roll with impact attenuating design and solid, uniform top surface.
      a. Sheet Size: As indicated on drawings.
      b. Sheet Size: ____ inches wide by ____ inches long.
      c. Tile Size: As indicated on drawings.
      d. Tile Size: ____ inches by ____ inches.

2.02 MATERIALS

A. Edge Anchoring: Wood-polymer composite lumber complying with ASTM D6662; factory finished, free of sharp vertical edges, protruding elements, and trip hazards, capable of being secured to border.
   1. Minimum Edge Radius: 1/2 inch.

B. Border: Permanent element surrounding edge anchoring, consisting of exterior walls:

C. Drainage (Loose Surfacing) Course: Fractured, non-rounded gravel; washed; free of dust, clay, dirt, organic material, hazardous substances, or foreign objects; rounded particles, either naturally or mechanically; sieved in compliance with ASTM C136/C136M in specified gradation range.
   1. Percent Passing Sieve Size 1/2 inch: 100 percent.
   2. Percent Passing Sieve Size 3/8 inch: 75 to 85 percent.
   3. Percent Passing Sieve Size No. 4: 0 percent.

D. Drainage (Base Stone) Course: Fractured, non-rounded gravel; washed; free of dust, clay, dirt, organic material, hazardous substances, or foreign objects; rounded particles, either naturally or mechanically; sieved in compliance with ASTM C136/C136M in specified gradation range.
   1. Percent Passing Sieve Size 1-1/2 inch: 100 percent.
   2. Percent Passing Sieve Size 3/4 inch: 75 to 85 percent.
   3. Percent Passing Sieve Size 1/2 inch: 40 to 70 percent.
   4. Percent Passing Sieve Size 3/8 inch: 75 to 85 percent.
   5. Percent Passing Sieve Size No. 4: 0 percent.

E. Geotextile: Nonwoven polypropylene sheet.

2.03 ACCESSORIES

A. Fasteners, Synthetic Grass to Edging: 1/2 inch (13 mm) stainless steel staples, in compliance with ASTM F1667.

B. Fasteners, Edging to Border: Self drilling, stainless steel screws, in compliance with ASTM F1667.

C. Fasteners, Seams:
   1. Nails: Galvanized steel, 4 inch (102 mm) long, in compliance with ASTM F1667.

PART 3 EXECUTION

3.01 SHOCK ABSORBING COURSE

3.02 SYNTHETIC GRASS

A. Carpet Rolls:
   1. Unroll all carpet in same direction.
   2. Prevent seams from being located over impact mats.
   3. Allow carpet to rest for at least 4 hours after unrolling and prior to seaming.
   4. Smooth seams and edges, eliminate overlaps and gaps.

B. Seaming:
   1. Cut: Straight, with clean and smooth edge.
   2. Method:

C. Securing: Staple carpet to edging 1 inch (25 mm) on center.

D. Field Graphics:

3.03 INFILL

A. Apply during dry weather without signs of moisture on synthetic grass.

B. Thoroughly brush synthetic grass prior to infill installation.

C. Apply infill uniformly in multiple lifts, brush fibers between each application.

D. Measure depth to confirm accordance with plans.

END OF SECTION 32 18 13

SECTION 32 31 13
CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Chain link fencing for exterior and interior application.

B. Posts, rails, and frames.

C. Wire fabric.

D. Barbed wire.

E. Concrete.

F. Accessories.

1.02 REFERENCE STANDARDS

A. ASTM A121 - Standard Specification for Metallic-Coated Carbon Steel Barbed Wire.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

C. ASTM A392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.

D. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

E. ASTM F567 - Standard Practice for Installation of Chain-Link Fence.

F. ASTM F1043 - Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework.

G. ASTM F1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.

H. CLFMI CLF-FIG0111 - Field Inspection Guide.

I. CLFMI CLF-PM0610 - Product Manual.

J. CLFMI CLF-SFR0111 - Security Fencing Recommendations.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on fabric, posts, accessories, fittings and hardware.

C. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components. See CLFMI CLF-SFR0111 for planning and design recommendations.

1.04 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Chain Link Fences and Gates:
   1. Master-Halco, Inc: www.masterhalco.com/#sle.
   2. Merchants Metals: www.merchantsmetals.com/#sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 COMPONENTS

A. Line Posts: 1.9 inch diameter.

B. Corner and Terminal Posts: 2.38 inch diameter.

C. Fabric with Pre-Inserted Slats: 2 inch diamond mesh interwoven wire, 6 gage, 0.1920 inch thick, top selvage knuckle end closed, bottom selvage twisted tight.
   1. Privacy Slats: High-density polyethylene (HDPE), woven into fabric.

2.03 MATERIALS

A. Posts, Rails, and Frames:
   1. ASTM A1011/A1011M, Designation SS; hot-rolled steel strip, cold formed to pipe configuration, longitudinally welded construction, minimum yield strength of 50 ksi; zinc coating complying with ASTM F1043 and ASTM F1083.
   2. Line Posts: Type I round.
   3. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round.
   4. Comply with CLFMI CLF-PM0610.

B. Wire Fabric:
   1. ASTM A392 zinc coated steel chain link fabric.
   2. Comply with CLFMI CLF-PM0610.

C. Barbed Wire:
   1. Zinc-coated steel, complying with ASTM A121 Type Z Coating Class 1; 2 strands of 0.099 inch diameter wire, with 2-pointed barbs at 4 inches on center.

D. Concrete:
   1. Ready-mixed, complying with ASTM C94/C94M; normal Portland cement; 2,500 psi strength at 28 days, 3 inch slump; aggregate.

2.04 COMPONENTS

A. Line Posts: 1.9 inch diameter.

B. Corner and Terminal Posts: 2.38 inch diameter.

C. Top and Brace Rail: 1.66 inch diameter, plain end, sleeve coupled.

D. Bottom Rail: 1.66 inch diameter, plain end, sleeve coupled.

E. Fabric: 2 inch diamond mesh interwoven wire, 6 gage, 0.1920 inch thick, top selvage knuckle end closed, bottom selvage twisted tight.

F. Tie Wire: Aluminum alloy steel wire.

2.05 ACCESSORIES

A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.

B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel.

2.06 FINISHES

A. Components (Other than Fabric): Galvanized in accordance with ASTM A123/A123M, at 1.7 ounces per square foot.

B. Accessories: Same finish as framing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that areas are clear of obstructions or debris.

3.02 INSTALLATION - EXTERIOR APPLICATION

A. Install framework, fabric, accessories and gates in accordance with ASTM F567.

B. Place fabric on outside of posts and rails.

C. Set intermediate, terminal, and gate posts plumb, in concrete footings with top of footing 2 inches above finish grade. Slope top of concrete for water runoff.

D. Line Post Footing Depth Below Finish Grade: ASTM F567.

E. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F567.

F. Brace each gate and corner post to adjacent line post with horizontal center brace rail. Install brace rail one bay from end and gate posts.

G. Provide top rail through line post tops and splice with 6 inch long rail sleeves.

H. Install a 7 gage, 0.1770 inch coil spring wire in place of top rail.

I. Do not stretch fabric until concrete foundation has cured 28 days.

J. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.

K. Position bottom of fabric 2 inches above finished grade.

L. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.

M. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.

N. Install bottom tension wire stretched taut between terminal posts.

O. Install support arms sloped outward and attach barbed wire; tension and secure.

P. Peen all bolts upon installation.

Q. Perform three random field inspections confirming proper installation.

3.03 INSTALLATION - INTERIOR APPLICATION

A. Install framework, fabric, accessories and gates in accordance with ASTM F567.

B. Set intermediate posts plumb, on anchor plate and collar with four bolts secured to concrete slab.

C. Brace each post by extending to roof structure. Provide lateral bracing rail to bridge between roof framing members

D. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.

E. Position bottom of fabric 1 inches above concrete slab.

F. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.

G. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.

H. Install bottom tension wire stretched taut between terminal posts.

I. Peen all bolts upon installation.

J. Perform three random field inspections confirming proper installation.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.

B. Maximum Offset From True Position: 1 inch.

C. Do not infringe on adjacent property lines.

3.05 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Layout: Verify that fence installation markings are accurate to design, paying attention to gate locations, underground utilities, and property lines.

C. Workmanship: Verify neat installation free of defects. See CLFMI CLF-FIG0111 for field inspection guidance.

3.06 CLEANING

A. Leave immediate work area neat at end of each work day.

B. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.

C. Clean fence with mild household detergent and clean water rinse well.

D. Remove mortar from exposed posts and other fencing material using a 10 percent solution of muriatic acid followed immediately by several rinses with clean water.

E. Touch up scratched surfaces using materials recommended by manufacturer. Match touched-up paint color to factory-applied finish.

F. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

END OF SECTION 32 31 13

SECTION 32 33 00

SITE FURNISHINGS

PART 1 GENERAL

PART 2 PRODUCTS

2.01 METAL FURNISHINGS

A. Metal Furnishings, General:
   1. Cast iron components: Ductile iron castings complying with ASTM A536; cleaned, treated, and powder-coated.
   2. Steel components: Plates, bars, and shapes complying with ASTM A36/A36M and tubing complying with ASTM A500/A500M; cleaned, treated, and powder-coated.
   3. Wood components: Western red cedar with eased edges, and clear wood preservative coating.
   4. Recycled plastic lumber (RPL) components:
   5. Hardware: Stainless steel.

B. Benches: Metal frame and seat section with back.
   1. Frame: Steel.
   2. Seat: Wood slat.

C. Waste Receptacles: Steel frame with steel slats and removable lid.
   1. Capacity: 20 gallons.

2.02 PRECAST CONCRETE FURNISHINGS

A. Precast Concrete Furnishings, General:
   1. Precast Concrete Components: Mixture of cement, aggregates, water, and mineral colors; molded to shape, and reinforced with steel bars.
      a. Finish:
         1) Horizontal Surfaces: Smooth for seats and table tops.
         2) Vertical Surfaces: Smooth for supports and sides.
      b. Color: As indicated on drawings.
      c. Clear Sealers: Anti-graffiti.
   2. Wood Components: Ipe with eased edges, and clear wood preservative coating.
   3. Recycled Plastic Lumber (RPL) Components:
      a. Color: As selected by Architect from manufacturer's standard range.
   4. Hardware: Stainless steel.

B. Benches: Frame and seat section with back.
   1. Frame: Precast concrete.
   2. Seat: Precast concrete.

C. Planters: Precast concrete with drain holes.

D. Tables: Precast concrete table and benches with umbrella hole in center of table.
   1. Table: Precast concrete frame with precast table top.

E. Waste Receptacles: Precast concrete waste receptacle with removable lid.
   1. Capacity: 20 gallons.

2.03 BOLLARDS

A. Steel Pipe Bollards: Hollow steel pipe with plain shaft.
   1. Materials:
      a. Steel Pipe: ASTM A53/A53M, standard weight.
      b. Factory Finish: Primed.

2.04 SKATE FURNISHINGS

A. Skate Deterrents:
   1. Material: Aluminum; ASTM B26/B26M, 319 alloy; clear anodized finish.
   2. Attachment: Surface mounted to benches, planters, tables, and table seating.

3. Anchoring: Tamper-resistant screws, pins or bolts as recommended by manufacturer.
4. Shape: Fixed radius curve.

PART 3 EXECUTION

3.01 INSTALLATION

END OF SECTION 32 33 00

SECTION 32 33 13

SITE BICYCLE RACKS

PART 1 GENERAL

PART 2 PRODUCTS

2.01 BICYLCE RACKS

A. Aluminum, anodized finish, galvanized hardware, bolted to concrete

3.01 BICYCLE RACKS

A. Materials:

PART 3 EXECUTION

4.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install level, plumb, square, and correctly located as indicated on drawings.

END OF SECTION 32 33 13

SECTION 32 92 19
SEEDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preparation of subsoil.

B. Placing topsoil.

C. Seeding.

1.02 RELATED REQUIREMENTS

A. Section 31 22 00 - Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this section.

B. Section 31 23 23 - Fill: Topsoil material.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable. Deliver seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

PART 2 PRODUCTS

2.01 SEED MIXTURE

A. Seed Mixture:
   1. Kentucky Blue Grass: 50 percent.
   2. Creeping Red Fescue Grass: 10 percent.
   3. Norlea Perennial Rye: 40 percent.

2.02 ACCESSORIES

A. Water: Clean, fresh and free of substances or matter that could inhibit vigorous growth of grass.

B. Erosion Fabric: Jute matting, open weave.

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare subgrade in accordance with Section 31 22 00 - Earth Moving.

B. Place topsoil in accordance with Section 31 22 00 - Earth Moving.

3.02 SEEDING

A. Apply seed at a rate of 2 to 3 lbs per 1000 sq ft evenly in two intersecting directions. Rake in lightly.

B. Do not seed areas in excess of that which can be mulched on same day.

C. Do not sow immediately following rain, when ground is too dry, or during windy periods.

D. Immediately following seeding and compacting, apply mulch to a thickness of 1/8 inches. Maintain clear of shrubs and trees.

E. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

F. Following germination, immediately re-seed areas without germinated seeds that are larger than 4 by 4 inches.

3.03 PROTECTION

A. Lay fabric smoothly on surface, bury top end of each section in 6 inch deep excavated topsoil trench. Provide 12 inch overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.

B. Secure outside edges and overlaps at 36 inch intervals with stakes.

C. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

3.04 MAINTENANCE

A. Maintain seeded areas immediately after placement until grass is well established and exhibits a vigorous growing condition.

B. Water to prevent grass and soil from drying out.

C. Roll surface to remove minor depressions or irregularities.

D. Immediately reseed areas that show bare spots.

END OF SECTION 32 92 19

SECTION 33 05 61

CONCRETE MANHOLES

PART 1 GENERAL

PART 2 PRODUCTS

2.01 CONCRETE MANHOLES

A. Weight Rating: H 10 according to AASHTO HB.

B. Precast Concrete Manholes: Comply with ASTM C478/C478M, reinforced.
   1. Wall Thickness: 6 inches.
   2. Base Thickness: 12 inches.
   3. Reinforcement: Formed steel wire, galvanized finish, wire diameter as indicated on drawings.
   4. Joint Sealant: Comply with ASTM C990.

C. Concrete Masonry Unit Manholes: Comply with ASTM C139, reinforced.
   1. Concrete Blocks: Curved, ___ by ___ by ___ inches, solid.
   2. Mortar: Type M, in accordance with ASTM C270.
   3. Reinforcement: Formed steel wire, galvanized finish, wire diameter as indicated on drawings.

D. Cast-In-Place Concrete Manholes: Comply with ASTM C94/C94M, reinforced.
   1. Wall Thickness: 6 inches.

E. Cast-In-Place Concrete Base Pads: Comply with ASTM C94/C94M, reinforced.
   1. Thickness: 12 inches.
   2. Reinforcement: Formed steel wire, galvanized finish, wire diameter as indicated on drawings.

F. Cast-In-Place Concrete Materials: See Section 03 30 00.

G. Polymer Concrete Manholes: Comply with ASTM D6783, reinforced.
   1. Wall Thickness: 6 inches.
   2. Base Thickness: 6 inches.
   3. Reinforcement: Fiber-reinforced polymer bars, in accordance with ACI 440.1R.
   4. Joint Sealant: Comply with ASTM C990.

H. Polymer Concrete Manhole Inserts: Comply with ASTM D6783, reinforced.
   1. Wall Thickness: 7 inches.
   2. Base Thickness: 6 inches.
   3. Reinforcement: Fiber-reinforced polymer bars, in accordance with ACI 440.1R.
   4. Joint Sealant: Comply with ASTM C990.

I. Polymer Mortar: Provided by the manufacturer.

J. Grade Adjustments:
   1. Concrete Bricks: ASTM C1634 or ASTM C55 Grade N, cored, normal weight; ___ by ___ by ___ inches.

K. Mortar Mixing:
   1. Thoroughly mix mortar ingredients in accordance with ASTM C270 and in quantities needed for immediate use.
   2. Maintain sand uniformly damp immediately before the mixing process.
   3. Do not use antifreeze compounds to lower the freezing point of mortar.
   4. Waterproofing Admixture: Surface applied.
   5. Microbiologically-Induced Corrosion-Inhibiting Admixture: Resists growth of bacteria and fungi on or inside concrete.

L. Frame and Cover: Cast iron construction, ASTM A48/A48M, Class 30B, machined flat bearing surface; hinged; sealing gasket.

2.02 ACCESSORIES

A. Steps: Formed galvanized steel rungs; 3/4 inch diameter. Formed integral with manhole sections.

B. Strap Anchors: Bent steel shape, __ by __ inch size by ____ inch thick, galvanized to ASTM A123/A123M, Grade specified for applicable material category.

PART 3 EXECUTION

3.01 INSTALLATION

A. Establish elevations and pipe inverts for inlets and outlets as indicated in drawings.

B. Precast Concrete Manholes:
   1. Place base section plumb and level.
   2. Install joint sealant uniformly around section lip.

C. Cast-In-Place Concrete Base Pad:
   1. Form bottom of excavation walls clean and smooth to correct limits.
   2. Install reinforcement in maximum lengths. Offset end laps in both directions. Splice laps with tie wire.
   3. Place concrete in accordance with ACI 304R.
   4. Float base pad top surface level.

D. Concrete Masonry Unit Manholes:
   1. Place full mortar bed on concrete base pad.
   2. Lay masonry units plumb on mortar with full head joints and uniform concave vertical joints.
   3. Maintain level running bond courses with uniform concave horizontal joints.
   4. Install joint reinforcement 16 inches on center.
   5. Taper diameter to opening in four courses.

E. Cast-In-Place Concrete Manholes:
   1. Form catch basin on concrete base pad plumb and level.
   2. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
   3. Place concrete in accordance with ACI 304R.
   4. Float catch basin top surface level.

F. Polymer Concrete Manholes: Install according to manufacturer's instructions.

G. Polymer Concrete Manhole Inserts: Install according to manufacturer's instructions.

H. Grade Adjustments:
   1. Lay brick or masonry units uniformly on mortar bed with full head joints, running bond. Top with mortar, plumb and level.
   2. Place adjacent materials tight, and smooth following design grades.

I. Frames and Covers:
   1. Place frame plumb and level.
   2. Mount frame on mortar bed at indicated elevation.
   3. Place grate in frame securely.

END OF SECTION 33 05 61

SECTION 33 14 16

SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

PART 2 PRODUCTS

2.01 WATER PIPE

A. Steel Pipe: Welded or Seamless complying with AWWA C200.
   1. Underground Pipe and Fittings: Cement-mortar lining and cement-mortar coating.
   2. Aboveground Pipe and Fittings: Cement-mortar lining.
   3. Fittings: AWWA C208.
   4. Minimum Wall Thickness: _____ inch based on _____ psi yield strength.
   5. Joints:
      a. Rubber Gasketed Bell and Spigot: Provide pipe manufacturer's standard design, meeting the requirements of AWWA C200.
      b. Welded: Provide electrodes complying with AWWA C206.
      c. Sleeve Type Mechanical Coupled:
         1) Designed to couple plain-end piping by compression of a ring gasket at each end of the adjoining pipe sections and provide for confinement and compression of gaskets.
         2) Bolts: Track head complying with ASTM A307, Grade A, with nuts complying with ASTM A563/A563M, Grade A.
      d. Grooved and Shouldered:
         1) Dimensions of grooves cut in adapters to comply with AWWA C606.
         2) Comply with AWWA C606 for pipe ends.
         3) Joint dimensions to comply with AWWA C606 for rigid joints and as indicated for flexible joints.
      e. Flanged:
         1) Steel Flanges: AWWA C207, Class D.
         2) Bolts, Nuts, and Rubber Gaskets: AWWA C207.
      f. Insulating Joints:
         1) Gaskets: Dielectric type, full face, as recommended in Appendix to AWWA C115/A21.15.
         2) Bolts and Nuts: As recommended in Appendix to AWWA C115/A21.15.

B. Ductile Iron Pipe: AWWA C151/A21.51:

C. Copper Tubing: ASTM B88, Type K, Annealed:

D. PVC Pipe: ASTM D1785, Schedule 40.

E. Polyethylene Pipe: ASTM D3035, for 45 psig pressure rating:

2.02 VALVES

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. Gate Valves Up To 3 Inches:
   1. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, compression ends, with control rod, post indicator, valve key, and extension box.

C. Gate Valves 3 Inches and Over:
   1. AWWA C500, iron body, bronze trim, non-rising stem with square nut, single wedge, flanged ends, control rod, post indicator, valve key, and extension box.

D. Ball Valves Up To 2 Inches:
   1. Brass body, Teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, AWWA inlet end, compression outlet with electrical ground connector, with control rod, valve key, and extension box.

E. Swing Check Valves From 2 Inches to 24 Inches:

1. AWWA C508, iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged ends.

F. Butterfly Valves From 2 Inches to 24 Inches:
1. AWWA C504, iron body, bronze disc, resilient replaceable seat, water or lug ends, ten position lever handle.

2.03 HYDRANTS

A. Hydrants: Type as required by utility company.

B. Finish: Primer and two coats of enamel in color required by utility company.

PART 3 EXECUTION

3.01 INSTALLATION - STEEL PIPE

3.02 INSTALLATION - VALVES AND HYDRANTS

A. Set valves on solid bearing.

B. Center and plumb valve box over valve. Set box cover flush with finished grade.

C. Set hydrants plumb; locate pumper nozzle perpendicular to and facing roadway in accordance with Section 21 11 00.

D. Set hydrants to grade, with nozzles at least 20 inches above ground in accordance with Section 21 11 00.

E. Locate control valve 4 inches away from hydrant.

F. Provide a drainage pit 36 inches square by 24 inches deep filled with 2 inches washed gravel. Encase elbow of hydrant in gravel to 6 inches above drain opening. Do not connect drain opening to sewer.

G. Paint hydrants in accordance with Section 09 91 13.

END OF SECTION 33 14 16

SECTION 33 31 13

SITE SANITARY SEWERAGE GRAVITY PIPING

PART 1 GENERAL

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

A. Provide products that comply with applicable code(s).

B. Cast Iron Soil Pipe: ASTM A74, service type, inside nominal diameter of ____ inches, hub and spigot end.

C. Joint Seals for Cast Iron Pipe: ASTM C564 rubber gaskets.

D. Ductile Iron Pipe: ASTM A746, Pressure Class 350, with asphaltic lining, inside nominal diameter of ____ inches, bell and spigot end.

E. Joint Seals for Ductile Iron Pipe: AWWA C111/A21.11; styrene butadiene rubber (SBR) or vulcanized SBR gaskets.

F. Vitrified Clay Pipe: ASTM C700, extra strength, unperforated; inside nominal diameter of ____ inches, bell and spigot end joints.

G. Joint Seals for Clay Pipe: ASTM C425 compression gasket joint devices.

H. Concrete Pipe: Nonreinforced, ASTM C14 or ASTM C14M, Class 1; inside nominal diameter of ____ inches, bell and spigot end joints.

I. Joint Seals for Concrete Pipe: ASTM C443 (ASTM C443M) rubber compression gaskets.

J. Plastic Pipe: ASTM D2680 Acrylonitrile-Butadiene-Styrene (ABS) material; inside nominal diameter of ____ inches, bell and spigot style solvent sealed joint end.

K. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

2.02 CLEANOUT MANHOLE

A. Lid and Frame: Cast iron construction, hinged lid.

B. Shaft Construction and Concentric Cone Top Section: Reinforced precast Concrete pipe sections, lipped male/female dry joints, cast steel ladder rungs into shaft sections at 12 inches; nominal shaft diameter of 36 inches.

PART 3 EXECUTION

3.01 TRENCHING

A. See Section 31 23 16.13 for additional requirements.

B. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.02 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
   1. Clay Pipe: Also comply with ASTM C12.
   2. Plastic Pipe: Also comply with ASTM D2321.

B. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

C. Connect to building sanitary sewer outlet and municipal sewer system, through installed sleeves.

3.03 INSTALLATION - CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.

C. Establish elevations and pipe inverts for inlets and outlets as indicated.

D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

END OF SECTION 33 31 13

SECTION 33 42 11

STORMWATER GRAVITY PIPING

PART 1 GENERAL

PART 2 PRODUCTS

2.01 STORMWATER PIPE MATERIALS

A. Provide products that comply with applicable code(s).

B. Concrete Pipe: Nonreinforced, ASTM C14 (ASTM C14M), Class 1; inside nominal diameter of ____ inches, bell and spigot end joints.

C. Concrete Pipe Joint Devices: ASTM C443 (ASTM C443M) rubber compression gasket joint.

D. Reinforced Concrete Pipe Joint Device: ASTM C443 (ASTM C443M) rubber compression gasket joint.

E. Plastic Pipe: ASTM D2680, Acrylonitrile-Butadiene-Styrene (ABS) material; inside nominal diameter of ____ inches, bell and spigot style solvent sealed joint end.

F. Corrugated Steel Pipe: AASHTO M 36 Type I; nominal diameter of ____ inches, _____ end joints; helical lock seam; coated inside and out with 0.050 inch thick bituminous coating.

PART 3 EXECUTION

3.01 TRENCHING

A. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.02 INSTALLATION

A. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
   1. Plastic Pipe: Also comply with ASTM D2321.

B. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

C. Connect to building storm drainage system, foundation drainage system, and utility/municipal system.

END OF SECTION 33 42 11

SECTION 33 46 00
STORMWATER MANAGEMENT

PART 1 GENERAL

PART 2 PRODUCTS

2.01 STORMWATER PONDS

A. Fill: See Section 31 23 23.

B. Impermeable Layer: Group A-4 in accordance with ASTM D3282.

C. Geogrid: Geogrid for stabilization as specified in Section 31 05 19.

2.02 OUTLET STRUCTURES FOR STORMWATER PONDS

A. Precast Concrete: Reinforced, integrated lift rings, in accordance with ASTM C913.
   1. Concrete: 4,000 psi minimum 28 day compressive strength.
   2. Wall Thickness: 4 inches (102 mm).

B. Corrugated Metal: Galvanized sheet steel in accordance with ASTM A929/A929M with helical lock seams.

C. Trash Racks: Cast iron, heavy duty bar screen.

D. Concrete Base: See Section 03 30 00.

2.03 MODULAR BURIED STORMWATER STORAGE UNITS

A. Modular Plastic: Open cell, interlocking, 100 percent recycled.

B. Geogrid: 1,300 lb/ft (19.0 kN/m) minimum ultimate tensile strength, when tested in accordance with ASTM D6637/D6637M.

C. Geomembrane: HDPE, comply with GRI GM13.

2.04 STORMWATER LEACHING PITS

A. Precast Concrete: Reinforced, integrated lift rings, inlet inspection hole, in accordance with ASTM C913.
   1. Concrete: 4,000 psi minimum 28 day compressive strength.
   2. Wall Thickness: 4 inches (102 mm).
   3. Perforations: 15 percent of wall area.

B. Concrete Masonry Unit: Solid, straight blocks.
   1. Concrete: 4,000 psi minimum 28 day compressive strength.
   2. Dimensions: 8 by 8 by 16 inches (203 by 203 by 406 mm).
   3. Cover: Precast, integrated lift rings.

C. Frame and Grate: ASTM A48/A48M, Class 30B cast iron construction, machined flat bearing surface.

PART 3 EXECUTION

3.01 POND CONSTRUCTION

A. Install geogrid according to manufacturer's instructions.

B. Fill to contours and elevations indicated using unfrozen materials.

C. Employ a placement method that does not disturb or damage other work.

D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen, or spongy subgrade surfaces.

3.02 POND OUTLET CONSTRUCTION

A. Form concrete base pad according to drawings, trowel top surface level.

B. Precast Structure: Place structure sections plumb and level, trim to correct elevations.
   1. Anchor to base pad.

C. Corrugated Structure: Install elbow fitting and sections plumb and level, trim to correct elevations.
   1. Anchor to base pad.

D. Set trash racks level without tipping, to correct elevations.

3.03 MODULAR UNIT INSTALLATION

A. Install modular units according to manufacturer's instructions.

B. Lay geogrid sheets on base in the direction of construction.

C. Lay geomembrane sheets on geogrid in the direction of construction.

D. Install modular units according to drawings, interlocking wherever possible.

E. Lay geogrid sheets on modular units in the direction of construction.

F. Cover top and sides of modular units with geomembrane, weld seams according to manufacturer's instructions.

G. Backfill without damaging modular units, geomembrane, or geogrid as specified in Section 31 23 23.

3.04 LEACHING PIT INSTALLATION

A. Precast Concrete: Place structure sections plumb and level, trim to correct elevations.

B. Concrete Masonry Unit: Place masonry units plumb and level in running bond with open joints.

C. Set cover level without tipping, to correct elevations.

D. Install frames and grate to correct position and elevation.

E. Backfill 12 inches (305 mm), minimum, around pit with stone as specified in Section 31 23 23.

END OF SECTION 33 46 00

SECTION 33 71 19

ELECTRICAL UNDERGROUND DUCTS AND MANHOLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Conduit and duct:
   1. Rigid polyvinyl chloride (PVC) conduit.
   2. High density polyethylene (HDPE) conduit.

B. Accessories:
   1. Underground warning tape.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 31 23 16 - Excavation.

C. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.

D. Section 31 23 23 - Fill: Bedding and backfilling.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 01 22 00 - Unit Prices, for additional unit price requirements.

B. Ductbank:
   1. Basis of Measurement: By the lineal foot (meter), for each configuration.
   2. Basis of Payment: Includes purchase, delivery, and installation of duct, fittings, supports, and accessories, and for trenching, concrete encasement, and backfill.

1.04 REFERENCE STANDARDS

A. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit.

B. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.

C. NEMA TC 7 - Smooth-Wall Coilable Electrical Polyethylene Conduit.

D. NFPA 70 - National Electrical Code.

E. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings.

F. UL 651A - Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide for metallic conduit, nonmetallic conduit, and manhole accessories.

C. Shop Drawings: Indicate dimensions, reinforcement, size and locations of openings, and accessory locations for precast manholes.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Project Record Documents: Record actual routing and elevations of underground conduit and duct, and locations and sizes of manholes.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 CONDUIT AND DUCT

A. Rigid Polyvinyl Chloride (PVC) Conduit: NFPA 70, Type PVC; comply with NEMA TC 2 and list and label as complying with UL 651; Schedule 40 unless otherwise indicated; rated for use with conductors rated 90 degrees C.
   1. Manufacturers:
      a. Cantex Inc: www.cantexinc.com.
      b. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com.
      c. JM Eagle: www.jmeagle.com.
      d. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Fittings: Comply with NEMA TC 3 and list and label as complying with UL 651.
      a. Manufacturer: Same as manufacturer of conduit to be connected.

B. High Density Polyethylene (HDPE) Conduit: NFPA 70, Type HDPE; comply with NEMA TC 7 and list and label as complying with UL 651A; Schedule 40 unless otherwise indicated.
   1. Manufacturers:
      a. Blue Diamond Industries, LLC: www.bdiky.com.
      b. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com.
      c. Dura-Line: www.duraline.com.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACCESSORIES

A. Underground Warning Tape: Polyethylene tape suitable for direct burial.
   1. Manufacturers:
      a. Brady Corporation: www.bradyid.com.
      b. Brimar Industries, Inc: www.brimar.com.
      c. Seton Identification Products: www.seton.com.
      d. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.
   3. Legend: Type of service, continuously repeated over full length of tape.
   4. Color:
      a. Tape for Buried Power Lines: Black text on red background.
      b. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.03 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify routing and termination locations of duct bank prior to excavation for rough-in.

C. Duct bank routing is shown in approximate locations unless dimensions are indicated. Route as required to complete duct system.

3.02 DUCT BANK INSTALLATION

A. Install duct to locate top of ductbank at depths as indicated on drawings.

B. Install duct with minimum slope of 4 inches per 100 feet (0.33 percent). Slope duct away from building entrances.

C. Cut duct square using saw or pipe cutter; de-burr cut ends.

D. Insert duct to shoulder of fittings; fasten securely.

E. Join nonmetallic duct using adhesive as recommended by manufacturer.

F. Install no more than equivalent of three 90-degree bends between pull points.

G. Provide suitable fittings to accommodate expansion and deflection where required.

H. Terminate duct at manhole entries using end bell.

I. Stagger duct joints vertically in concrete encasement 6 inches minimum.

J. Use suitable separators and chairs installed not greater than 4 feet on centers.

K. Band ducts together before backfilling.

L. Securely anchor duct to prevent movement during concrete placement.

M. Place concrete under provisions of Section 03 30 00. Use mineral pigment to color concrete red.

N. Provide minimum 3 inch concrete cover at bottom, top, and sides of ductbank.

O. Provide two No. 4 steel reinforcing bars in top of bank under paved areas.

P. Provide suitable pull string in each empty duct except sleeves and nipples.

Q. Swab duct. Use suitable caps to protect installed duct against entrance of dirt and moisture.

R. Interface installation of underground warning tape with backfilling. Install tape 6 inches below finished surface.

END OF SECTION 33 71 19