NEW BRUNSWICK TRAIN STATION
ELEVATOR UPGRADES
FEDERAL PROJECT NO.: DEM-D00S (006)

SPECIFICATIONS

June 9, 2016

Submitted by:

Gannett Fleming
NEW BRUNSWICK TRAIN STATION
ELEVATOR UPGRADES
FEDERAL PROJECT NO.: DEM-D00S (006)

SPECIFICATIONS

June 9, 2016

Submitted by:

Gannett Fleming
NEW JERSEY TRANSIT - NEW BRUNSWICK STATION
ELEVATOR UPGRADE
FEDERAL PROJECT NO.:

TABLE OF CONTENTS

DIVISION 2 - SITE CONSTRUCTION

02225 Minor Demolition for Remodeling
02315 Excavation and Fill
02821 Chain Link Fences and Gates

DIVISION 3 - CONCRETE

03100 Concrete Forms and Accessories
03200 Concrete Reinforcement
03300 Cast-In-Place Concrete
03600 Grout

DIVISION 4 - MASONRY

04065 Masonry Mortar and Grout
04720 Cast Stone
04810 Unit Masonry Assemblies
04900 Masonry Restoration and Cleaning

DIVISION 5 - METALS

05120 Structural Steel
05312 Steel Roof Deck
05400 Cold Formed Metal Framing
05500 Metal Fabrications
05810 Expansion Joint Cover Assemblies

DIVISION 6 - WOOD AND PLASTICS

06112 Framing and Sheathing
06114 Wood Blocking and Curbing
06200 Finish Carpentry

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

07550 Modified Bituminous Membrane
07613 Manufactured Sheet Metal Roofing
07620 Sheet Metal Flashing and Trim
07714 Gutters and Downspouts
07840 Firestopping
07900  Joint Sealers

DIVISION 8 - DOORS AND WINDOWS

08114  Standard Steel Doors
08115  Standard Steel Frames
08511  Rolled Steel Windows
08550  Wood Windows
08710  Door Hardware
08800  Glazing

DIVISION 9 - FINISHES

09670  Fluid-Applied Flooring
09900  Paints and Coatings

DIVISION 10 - SPECIALTIES

10523  Fire Extinguishers and Cabinets

DIVISION 11 - EQUIPMENT

NOT USED

DIVISION 12 - FURNISHINGS

NOT USED

DIVISION 13 - SPECIAL CONSTRUCTION

NOT USED

DIVISION 14 - CONVEYING SYSTEMS

14240  Hydraulic Elevator

DIVISION 15 - MECHANICAL

15000  Basic Mechanical Requirements
15060  Hangers and Supports
15075  Mechanical Identification
15080  Mechanical Insulation
15105  Pipes and Tubes
15110  Valves
15184  Refrigerant Piping
15440  Plumbing Pumps
15739  Split System Air Conditioning
15940  Sequence of Operation
15950  Testing, Adjusting, and Balancing

DIVISION 16 - ELECTRICAL

16000  Basic Electrical Requirements
16060  Grounding and Bonding
16070  Electrical Hangers and Supports
16075  Electrical Identification
16080  Electrical Testing
16095  Electrical Demolition
16130  Raceway and Boxes
16132  Building Wire and Cable
16140  Wiring Devices
16150  Wiring Connections
16410  Power Module Switch
16411  Enclosed Switches
16442  Panelboards
16500  Lighting

END OF SECTION
SECTION 02225
MINOR DEMOLITION FOR REMODELING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Demolishing designated building equipment and fixtures.
   2. Demolishing designated construction.
   3. Cutting and alterations for completion of the Work.
   4. Removing designated items for reuse and/or salvage.
   5. Protecting items designated to remain.
   6. Removing demolished materials.

1.2 SUBMITTALS

A. Submit under the requirements of the General Provisions for Construction.

B. Demolition Schedule: Indicate overall schedule and interruptions required for utility and building services.

C. Shop Drawings:
   1. Indicate demolition and removal sequence.
   2. Indicate location of items designated for reuse and/or salvage.
   3. Indicate location and construction of temporary work.

1.3 CLOSEOUT SUBMITTALS

A. Submit under the requirements of the General Provisions for Construction.

B. Project Record Documents: Accurately record actual locations of capped utilities, concealed utilities discovered during demolition, and subsurface obstructions.

1.4 QUALITY ASSURANCE

A. Conform to applicable requirements of the NJ Uniform Construction Code and its adopted subcodes for demolition work, dust control, products requiring electrical disconnection and/or re-connection.

B. Conform to applicable disposal and handling requirements of the NJ Department of Environmental Protection when regulated, hazardous or contaminated materials are encountered.

C. Conform to applicable utility company requirements for demolition work involving disconnection, removal and/or capping/plugging of water, sewer, gas, electrical, telephone and other utility services.
D. Obtain all required permits from authorities having jurisdiction.

1.5 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.6 SEQUENCING

A. Sequence activities in the following stages:
   1. Submit sequence of activities for NJ Transit’s and engineer’s approval prior to beginning of work.

B. Conduct salvage operations before demolition begins to remove materials NJ TRANSIT chooses to retain.

1.7 SCHEDULING

A. Schedule Work to coincide with other construction as applicable.

B. Cooperate with NJ TRANSIT in scheduling noisy operations and/or waste removal work that may impact facility operations or affect adjacent properties.

C. Coordinate utility and building service interruptions with Owner.
   1. Do not disable or disrupt building fire or life safety systems without 48 hours prior written notice to Construction Manager.
   2. Schedule tie-ins to existing systems to minimize disruption.
   3. Coordinate Work to ensure fire sprinklers, fire alarms, smoke detectors, emergency lighting, exit signs and other life safety systems remain in full operation in occupied areas.

1.8 PROJECT CONDITIONS

A. Conduct demolition to minimize interference with adjacent and occupied building areas.

B. Cease operations immediately if structure appears to be in danger and notify Construction Manager. Do not resume operations until directed.

PART 2 PRODUCTS

Not Used.
PART 3 EXECUTION

3.1 PREPARATION

A. Notify affected utility companies before starting work and comply with their requirements.

B. Mark location and termination of utilities.

C. Erect, and maintain temporary barriers and security devices as required and at locations specifically indicated, including warning signs and lights, and similar measures, for protection of the building occupants, passersby, and existing improvements indicated to remain.

D. Layout cuts in post-tensioned concrete elements to avoid cutting concrete within 12 inches of any stressing tendon. Notify Construction Manager minimum 48 hours in advance of cutting post-tensioned concrete.

E. Erect and maintain weatherproof closures for exterior openings.

F. Erect and maintain temporary partitions to prevent spread of dust, odors, and noise to permit continued Owner occupancy.

G. Prevent movement of structure; provide temporary bracing and shoring required to ensure safety of existing structure.

H. Provide appropriate temporary signage including signage for exit or building egress.

I. Do not close or obstruct any building egress path.

3.2 SALVAGE REQUIREMENTS

A. Coordinate with Construction Manager to identify building components and equipment required to be removed and delivered to NJ TRANSIT.

B. Tag components and equipment NJ TRANSIT designates for salvage.

C. Protect designated salvage items from demolition operations until items can be removed.

D. Carefully remove building components and equipment indicated to be salvaged.

E. Disassemble as required to permit removal from building.

F. Package small and loose parts to avoid loss.

G. Mark equipment and packaged parts to permit identification and consolidation of components of each salvaged item.
H. Prepare assembly instructions consistent with disassembled parts. Package assembly instructions in protective envelope and securely attach to each disassembled salvaged item.

I. Deliver salvaged items to Owner. Obtain signed receipt from Construction Manager.

3.3 DEMOLITION

A. Conduct demolition to minimize interference with adjacent and occupied building areas.

B. Maintain protected egress from and access to adjacent existing buildings at all times.

C. Do not close or obstruct roadways and/or sidewalks without permits.

D. Cease operations immediately when structure appears to be in danger and notify Construction Manager.

E. Disconnect and remove designated utilities within demolition areas.

F. Cap and identify abandoned utilities at termination points when utility is not completely removed. Annotate Record Drawings indicating location and type of service for capped utilities remaining after demolition.

G. Demolish in orderly and careful manner. Protect existing improvements, supporting structural members and building utilities.

H. Carefully remove building components indicated to be reused.
   1. Disassemble components as required to permit removal.
   2. Package small and loose parts to avoid loss.
   3. Mark components and packaged parts to permit reinstallation.
   4. Store components, protected from construction operations, until reinstalled.

I. Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.

J. Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.

K. Remove temporary Work.
PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the DIVISION 2 lump sum bid item ALL REMAINING WORK.

END OF SECTION
SECTION 02315
EXCAVATION AND FILL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Soil densification.
   2. Excavating for building foundations.
   3. Excavating for slabs-on-grade.
   4. Excavating for site structures.

1.2 REFERENCES

A. ASTM International:
   1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
   2. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
   3. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

B. New Jersey Department of Transportation:
   1. NJDOT - 2001 Standard Specifications for Road and Bridge Construction.

C. Other:
   1. Local utility standards when working within 24 inches of utility lines.

1.3 SUBMITTALS

A. Submit under the requirements of the General Provisions for Construction.

B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

C. Shop Drawings: Indicate soil densification grid for each size and configuration footing requiring soils densification.
1.4 QUALITY ASSURANCE
   A. Perform Work in accordance with NJDOT Standard Specifications for Road and Bridge Construction.
   B. Maintain one copy of document on site.

1.5 QUALIFICATIONS
   A. Prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of New Jersey.

PART 2 PRODUCTS
   Not Used.

PART 3 EXECUTION

3.1 PREPARATION
   A. Call Local Utility Line Information service not less than three working days before performing Work. Request underground utilities to be located and marked within and surrounding construction areas.
   B. Identify required lines, levels, contours, and datum.
   C. Protect utilities indicated to remain from damage.
   D. Protect plant life, lawns, and other features remaining as portion of final landscaping.
   E. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.2 SOIL DENSIFICATION - VIBRO-COMPACTION
   A. Vibro-compact substrates below footing bearing surfaces for footings as indicated on Drawings before excavating site.
   B. Densify existing subsoils with relative density rating of compact to dense to attain relative density rating of very dense.
      1. Densify subsoils to depth of 6 feet.
   C. Densification Equipment:
      1. Depth Vibrator: Poker type with follower tubes with visible marking every 12 inches to enable insertion depth measurement.
2. Motion: radial in horizontal plane.
3. Data Acquisition System: Record amps or pressure of the vibrator motor over time and depth.

D. Perform densification in presence of Construction Manager directly under each footing with vibrator inserted in grid pattern at maximum 6 feet on center.
   1. Arrange compaction grid for each footing for maximum number of insertion points and with outermost insertion points within the bearing area of footings.
   2. Adjust compaction grid arrangement and spacing as directed by Construction Manager to achieve required densification.

E. Insert vibrator to maximum specified depth. Densify soils for 30 seconds or other time as directed by Construction Manager. Withdraw vibrator every 12 inches increments and repeat densification at each increment.
   1. When subsurface obstruction prevents vibrator insertion to specified depth, request instructions from Construction Manager to compensate for obstruction.

F. Tolerances:
   1. Maximum Deviation from Center of Completed Compaction: 8 inches from indicated position.
   2. Maximum Deviation from Vertical: 4 degrees during vibrator insertion.

3.3 EXCAVATION

A. Underpin adjacent structures which may be damaged by excavation work.

B. Excavate subsoil to accommodate foundations and site structures.

C. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity.

D. Do not interfere with 45 degree bearing splay of foundations.

E. Grade top perimeter of excavation to prevent surface water from draining into excavation.

F. Trim excavation. Remove loose matter.

G. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd measured by volume. Notify Architect/Engineer of unexpected subsurface conditions.

H. Correct areas over excavated as directed by Construction Manager.

I. Remove excess and unsuitable material from site.

J. Repair or replace items indicated to remain damaged by excavation.
3.4 PROTECTION

A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item for DIVISION 2 - ALL REMAINING WORK.

END OF SECTION
SECTION 02821
CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fence framework, fabric, and accessories.
   2. Excavation for post bases.
   3. Concrete foundation for posts and center drop for gates.
   4. Gates and related hardware.

1.2 REFERENCES

A. ASTM International:
   1. ASTM A90 - Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
   2. ASTM A121 - Standard Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.

B. Chain Link Fence Manufacturers Institute:
   1. CLFMI - Product Manual.

C. New Jersey Department of Transportation:
   1. NJDOT - 2001 Standard Specifications for Road and Bridge Construction.
1.3 SYSTEM DESCRIPTION
A. Fence Height: 8'-0" feet nominal, located as indicated on Drawings.
B. Line Post Spacing: At intervals not exceeding 10'-0" on center.
C. Fence Post and Rail Strength: Conform to ASTM F1043 Heavy Industrial Fence quality.

1.4 SUBMITTALS
A. Submit under the requirements of the General Provisions for Construction.
B. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.
C. Product Data: Submit data on fabric, posts, accessories, fittings and hardware.
D. Manufacturer's Installation Instructions: Submit installation requirements.

1.5 CLOSEOUT SUBMITTALS
A. Submit under the requirements of the General Provisions for Construction.
B. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines and easements.
C. Operation and Maintenance Data: Procedures for submittals.

1.6 QUALITY ASSURANCE
A. Supply material in accordance with CLFMI - Product Manual.
B. Perform installation in accordance with CLFMI - Product Manual, ASTM F567 and ASTM F900, except as otherwise noted on Drawings.
C. Perform Work in accordance with NJDOT Standard Specifications for Road and Bridge Construction.

1.7 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
B. Installer: Company specializing in performing work of this section with minimum three years documented experience.
1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.

B. Deliver fence fabric and accessories in packed cartons or firmly tied rolls.

C. Identify each package with manufacturer’s name.

D. Store fence fabric and accessories in secure and dry place.

PART 2 PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. Materials and Components: Conform to the following sections of the CLFMI Product Manual:

B. Fabric: CLFMI Standard Industrial/Heavy Industrial service; 1-inch diamond mesh interwoven hot-dipped galvanized steel wire, 9-gauge thick, top and bottom selvage knuckle end closed.

C. Intermediate Posts: Type I round; ASTM F1083 Schedule 40 hot-dipped galvanized steel pipe, 2⅜-inch minimum diameter.

D. Terminal and Corner Posts: Type I round; ASTM F1083 Schedule 40 hot-dipped galvanized steel pipe, 2⅞-inch minimum diameter.

E. Rails and Braces: Type I round; ASTM F1083 Schedule 40 hot-dipped galvanized steel pipe, 1⅔-inch minimum diameter.

F. Post Tops: Combination type, hot-dipped galvanized cast steel or malleable iron, sized to post diameter, with three strand connection 45-degree barbed wire supporting arms, set screw retainer, and provision for passage of top rail where installed.

G. Tension Wire: ASTM A824 marcelled 7-gauge zinc coated wire fabric.

H. Barbed Wire: ASTM A121 chain link fence grade twisted dual strand 12½-gauge galvanized steel wire with four-point galvanized steel barbs on 5-inch spacing.

I. Tension Bar: 0.1875 inch thick x ¾-inch wide hot-dipped galvanized steel, minimum 2-inches shorter than fabric height.

J. Tension Band: ASTM F626 0.078-inch thick x ¾-inch wide hot-dipped galvanized steel, spaced at maximum 15-inch intervals.
K. Tie Wire: Aluminum alloy steel wire.

L. Concrete: ASTM C94/C94M, Option A; Normal Portland Cement, 2,500-psi strength at 28 days.

M. Gate Posts:
   1. Pedestrian Gates: 2⅞-inch diameter, unless otherwise noted.

N. Gate Frames:
   1. Pedestrian Gates: 1½-inch diameter for framing and bracing, unless otherwise noted.

O. Gate Hardware: Fork latch with gravity drop, two 180-degree gate hinges for each leaf.

2.2 GATES

A. General:
   1. Gate Types, Opening Widths and Directions of Operation: As indicated on Drawings.
   2. Factory assemble gates.
   3. Design gates for operation by one person.

B. Swing Gates:
   1. Fabricate gates to permit 180 degree swing.
   2. Gates Construction: ASTM F900 with welded corners. Use of corner fittings is not permitted.

2.3 EXAMINATION

A. Verify existing conditions prior to beginning work.

B. Verify field measurements are as shown on Drawings.

C. Verify that branch circuit wiring installation is completed, tested, of proper voltage and operating characteristics, and ready for connection to gate operator.

2.4 DEMOLITION

Not Used

2.5 INSTALLATION


B. Set posts plumb in concrete footings, with top of footing 2 inches above finish grade and crowned for water runoff.
C. Post Footing Depth Below Finish Grade: Minimum 3 feet.

D. Brace each gate, terminal and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from gate, terminal and corner posts.

E. Install top rail through line post tops and splice with 6-inch long rail sleeves.

F. Install center and bottom brace rail on corner gate leaves.

G. Place fabric on outside of posts and rails.

H. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.

I. Position bottom of fabric maximum 2 inches above finished grade.

J. Fasten fabric to top rail, line posts, braces, and top and bottom tension wire with tie wire at maximum 15 inches on centers.

K. Attach fabric to gate, terminal and corner posts with tension bars and tension bar clips.

L. Install top and bottom tension wire stretched taut between terminal posts.

M. Install support arms sloped outward and attach barbed wire; tension and secure.

N. Support gates from gate posts. Install two hinges on each gate leaf.

O. Install gate with fabric and barbed wire overhang to match fence. Install hinges, latch, catches, drop bolt and socket.

P. Provide concrete center drop to footing depth and drop rod retainers at center of double gate openings.

Q. Install posts with 6 inches maximum clear opening from end posts to buildings, fences and other structures.

R. Excavate holes for posts to diameter and spacing specified without disturbing underlying materials.

S. Center and align posts. Place concrete around posts, and vibrate or tamp for consolidation. Verify vertical and top alignment of posts and make necessary corrections.

T. Extend concrete footings 2 inches above grade, and trowel, forming crown to shed water.
U. Allow footings to cure minimum 7 days before installing fabric and other materials attached to posts. Do not stretch fabric until concrete foundation has cured 28 days.

V. Ground and bond fence in accordance with NJ TRANSIT requirements for fence installations in electrified territory. Bond fence to buried ground rods installed every 150 linear feet using #4/0 AWG bare copper bonding conductor and exothermic weld or mechanical connectors. Refer to Section 16060.

2.6 ERECTION TOLERANCES

A. Maximum Variation From Plumb: ¼-inch.


C. Minimum distance from property line: 6-inches, unless otherwise indicated.

PART 3 COMPENSATION

3.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item for Division 2.

END OF SECTION
SECTION 03100
CONCRETE FORMS AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Formwork for cast-in place concrete.
2. Shoring, bracing, and anchorage.
3. Form accessories.
4. Form stripping.

B. Related Sections:
1. Section 03200 - Concrete Reinforcement.
2. Section 03300 - Cast-in-Place Concrete.
3. Section 04810 - Unit Masonry Assemblies: Product requirements for masonry accessories for placement by this Section.
4. Section 05500 - Metal Fabrications: Product requirements for metal fabrications for placement by this Section.
5. Section 07620 - Sheet Metal Flashing and Trim: Product requirements for flashing reglets for placement by this Section.

1.2 REFERENCES

A. American Concrete Institute:
2. ACI 318 - Building Code Requirements for Structural Concrete.
3. ACI 347 - Guide to Formwork for Concrete.

B. American Forest and Paper Association:
1. AF&PA - National Design Specifications for Wood Construction.

C. The Engineered Wood Association:

D. American Society of Mechanical Engineers:

E. ASTM International:
1.3 DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing in accordance with NJDOT (roadways, driveways and sidewalks/plazas) or ACI 318 (platforms and building structures) to conform to applicable requirements to achieve concrete shape, line and dimension as indicated on Drawings.

1.4 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Shop Drawings:
   1. Submit formwork, shoring, and reshoring shop drawings.
   2. Indicate the following:
      a. Pertinent dimensions, openings, methods of construction, types of connections, materials, joint arrangement and details, ties and shores, location of framing, studding and bracing, and temporary supports.
      b. Means of leakage prevention for concrete exposed to view in finished construction.
      c. Sequence and timing of erection and stripping assumed compressive strength at time of stripping, height of lift and height of drop during placement.
      d. Vertical, horizontal and special loads in accordance with ACI 347, Section 2.2 and camber diagrams, when applicable.
      e. Notes to formwork erector showing size and location of conduits and piping embedded in concrete in accordance with ACI 318, Section 6.3.

C. Product Data: Submit data on void form materials and installation requirements.

D. Design Data: Signed and sealed by Professional Engineer licensed in the State of New Jersey.
   1. Indicate design data for formwork, shoring and/or reshores.
   2. Indicate loads transferred to structure during process of concreting, shoring and reshoring.
   3. Include structural calculations to support design.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 318.
B. For wood products furnished for work of this Section, comply with AF&PA.

1.6 QUALIFICATIONS
A. Design formwork structurally required to withstand superimposed loads or vertical and lateral forces under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of New Jersey.

1.7 MOCK-UP
A. Not required.

1.8 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.
B. Deliver void forms and installation instructions in manufacturer's packaging.
C. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.9 COORDINATION
A. Coordinate this Section with other sections of work, requiring attachment of components to formwork.

PART 2 PRODUCTS

2.1 WOOD FORM MATERIALS

A. Lumber Forms:
   1. Application: Use for edge forms and unexposed finish concrete.
   2. Boards: 6 inches or 8 inches in width, shiplapped or tongue and groove, “Standard” Grade Douglas Fir, conforming to WCLIB Standard Grading Rules for West Coast Lumber. Surface boards on four sides.

B. Plywood Forms:
   2. Forms: Conform to PS 1; full size 4 x 8 feet panels; each panel labeled with grade trademark of APA/EWA; mill treated and edge sealed.

2.2 PREFABRICATED FORMS

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

B. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

C. Pan Type: Steel or glass fiber, of size and profile required, stiffened to resist plastic concrete loads without detrimental deformation.

D. Tubular Column Type: Round, spirally wound laminated fiber material, surface treated with release agent, non-reusable, sized as indicated on Drawings.

E. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; 2 inches thick.

F. Steel Forms: Sheet steel, suitably reinforced, and designed for particular use indicated on Drawings.

G. Form Liners: Smooth, durable, grainless and non-staining hardboard, unless otherwise indicated on Drawings.

H. Framing, Studding and Bracing: Stud or No. 3 structural light framing grade.

2.3 FORMWORK ACCESSORIES

A. Form Ties: Removable or snap-off type, galvanized metal, adjustable length, cone type, 1½-inch back break dimension, free of defects capable of leaving holes larger than 1-inch in concrete surface.

B. Spreaders: Standard, non-corrosive metal form clamp assembly, of type acting as spreaders and leaving no metal within 1 inch of concrete face. Wire ties, wood spreaders or through bolts are not permitted.

C. Form Anchors and Hangers:
   1. Do not use anchors and hangers exposed concrete leaving exposed metal at concrete surface.
   2. Symmetrically arrange hangers supporting forms from structural steel members to minimize twisting or rotation of member.
   3. Penetration of structural steel members is not permitted.
D. Form Release Agent: Colorless mineral oil that will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.

E. Dovetail Anchor Slot: Galvanized steel, minimum 22 gauge thick, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

F. Flashing Reglets: Galvanized steel, minimum 22 gauge thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

G. Vapor Retarder: Where indicated on Drawings, 8 mil thick polyethylene sheet.


I. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Size, strength and character to maintain formwork in place while placing concrete.

J. Water Stops: Rubber or polyvinyl chloride, minimum 1,750 psi tensile strength, minimum 50 to 175 degrees F working temperature range, sized as indicated on drawings, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify lines, levels, and centers before proceeding with formwork. Verify dimensions agree with Drawings.

B. When formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Construction Manager.

3.2 INSTALLATION

A. Earth Forms: Earth forms are only permitted for site work where approved by the Construction Manager and subject to the following conditions:
   1. Trench earth forms neatly, accurately, and at least 2 inches wider than footing widths indicated on Drawings.
   2. Trim sides and bottom of earth forms.
   3. Construct wood edge strips at top of each side of trench to secure reinforcing and prevent trench from sloughing.
   4. Form sides of footings where earth sloughs.
   5. Tamp earth forms firm and clean forms of debris and loose material before depositing concrete.
B. Formwork - General:
   1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
   2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
   3. Camber forms where necessary to produce level finished soffits unless otherwise shown on Drawings.
   4. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
   5. Complete wedging and bracing before placing concrete.

C. Forms for Smooth Finish Concrete:
   1. Use steel, plywood or lined board forms.
   2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
   3. Install form lining with close-fitting square joints between separate sheets without springing into place.
   4. Use full size sheets of form lines and plywood wherever possible.
   5. Tape joints to prevent protrusions in concrete.
   6. Use care in forming and stripping wood forms to protect corners and edges.
   7. Level and continue horizontal joints.
   8. Keep wood forms wet until stripped.

D. Architectural Form Liners:
   1. Erect architectural side of formwork first.
   2. Attach form liner to forms before installing form ties.
   3. Install form liners square, with joints and pattern aligned.
   4. Seal form liner joints to prevent grout leaks.
   5. Dress joints and edges to match form liner pattern and texture.

E. Forms for Surfaces to Receive Membrane Waterproofing: Use plywood or steel forms. After erection of forms, tape form joints to prevent protrusions in concrete.

F. Framing, Studding and Bracing:
   1. Space studs at 16 inches on center maximum for boards and 12 inches on center maximum for plywood.
   2. Size framing, bracing, centering, and supporting members with sufficient strength to maintain shape and position under imposed loads from construction operations.
   3. Construct beam soffits of material minimum of 2 inches thick.
   4. Distribute bracing loads over base area on which bracing is erected.
   5. When placed on ground, protect against undermining, settlement or accidental impact.
G. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 318.

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

I. Obtain Architect/Engineer’s approval before framing openings in structural members not indicated on Drawings.

J. Install fillet and chamfer strips on external corners of beams, joists and columns.

K. Install void forms in accordance with manufacturer's recommendations.

L. Do not reuse forms that cannot meet requirements for new forms with respect to appearance and structural stability of concrete.
   1. Do not reuse forms where such practice will delay or change the concrete pour schedule that could be achieved if all formwork were new (wood formwork) or sufficiently available (metal formwork).
   2. Do not reuse plywood formwork more than five times.
   3. For exposed work, do not reuse forms with damaged faces or edges.
   4. Do not patch formwork.

3.3 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.

C. Do not apply form release agent where concrete surfaces are indicated to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

D. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. Apply form coating to forms in accordance with manufacturer’s specifications. Do not coat forms for concrete indicated to receive “scored finish”. Apply form coatings before placing reinforcing steel.

3.4 INSTALLATION - INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Install formed openings for items to be embedded in or passing through concrete work.

B. Locate and set in place items required to 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. Position recessed reglets for brick veneer masonry anchors in accordance with spacing and intervals specified in Section 04810, and as indicated on Drawings.

E. Install accessories straight, level, and plumb. Ensure items are not disturbed during concrete placement.

F. Install water stops continuous without displacing reinforcement. Heat seal joints watertight.

G. 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.

H. 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.

I. Form Ties:
   1. Use sufficient strength and sufficient quantity to prevent spreading of forms.
   2. Place ties at least 1 inch away from finished surface of concrete.
   3. Leave inner rods in concrete when forms are stripped.
   4. Space form ties equidistant, symmetrical and aligned vertically and horizontally unless otherwise shown on Drawings.

J. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

K. Construction Joints:
   1. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
   2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.
   3. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
   4. Arrange joints in continuous line straight, true and sharp.

L. Embedded Items:
   1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
   2. Do not embed wood or uncoated aluminum in concrete.
   3. Obtain installation and setting information for embedded items furnished under other Specification sections.
   4. Securely anchor embedded items in correct location and alignment prior to placing concrete.
5. Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 for size and location limitations.

M. Openings for Items Passing Through Concrete:
   1. Frame openings in concrete where indicated on Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
   2. Coordinate work to avoid cutting and patching of concrete after placement.
   3. Perform cutting and repairing of concrete required as result of failure to provide required openings.

N. Screeds:
   1. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.
   2. Slope slabs to drain where required or as shown on Drawings.
   3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water.

O. Screed Supports:
   1. For concrete over waterproof membranes and vapor barrier membranes, use cradle, pad or base type screed supports which will not puncture membrane.
   2. Staking through membrane is not permitted.

P. Cleanouts and Access Panels:
   1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris and waste material.
   2. Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust, and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

3.5  FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.
3.6 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and removal has been approved by Architect/Engineer.

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 in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

D. Leave forms in place for minimum number of days as specified in ACI 347.

3.7 ERECTION TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 318.

B. Construct formwork to produce completed concrete surfaces within construction tolerances specified in ACI 117.

C. Construct and align formwork for elevator hoistway in accordance with ASME A17.1.

D. Camber slabs and beams in accordance with ACI 318.

3.8 FIELD QUALITY CONTROL

A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

B. Notify Architect/Engineer after placement of reinforcing steel in forms, but prior to placing concrete.

C. Schedule concrete placement to permit formwork inspection before placing concrete.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item CONCRETE.

END OF SECTION
SECTION 03200
CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Reinforcing bars.
   3. Reinforcement accessories.

B. Related Sections:
   1. Section 03100 - Concrete Forms and Accessories.
   2. Section 03300 - Cast-in-Place Concrete.
   3. Section 04810 - Unit Masonry Assemblies: Reinforcement for masonry.

1.2 REFERENCES

A. American Concrete Institute:
   1. ACI 318 - Building Code Requirements for Structural Concrete.

B. ASTM International:
   1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
   3. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
   5. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   7. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
   8. ASTM A775/A775M - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

C. American Welding Society:
   1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.
D. Concrete Reinforcing Steel Institute:
   2. CRSI - Placing Reinforcing Bars.

E. New Jersey Department of Transportation:
   1. NJDOT - 2001 Standard Specifications for Road and Bridge Construction.

1.3 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and welded wire fabric, bending and cutting schedules, and supporting and spacing devices.

C. Certificates: Submit AWS qualification certificate for welders employed on the Work.

D. Manufacturer’s Certificate: Certify Products meet or exceed specified requirements. Submit certified copies of mill test report of reinforcement materials analysis.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with NJDOT (roadways, driveways and sidewalks/plazas) or ACI 318 (platforms and building structures).

B. Prepare shop drawings in accordance with ACI SP-66.

1.5 QUALIFICATIONS

A. Welders: AWS qualified within previous 12 months.

1.6 COORDINATION

A. Coordinate with placement of formwork, formed openings and other Work.

PART 2 PRODUCTS

2.1 REINFORCEMENT

A. Deformed Reinforcement: ASTM A615/A615M; 60 ksi yield strength, steel bars, unfinished unless otherwise noted on Drawings.

B. Deformed Bar Mats: ASTM A184/A184M; fabricated from ASTM A615/A615M; 60 ksi yield strength, steel bars, plain unless either of the following finishes are noted on Drawings:
   1. Galvanized: ASTM A767/A767M, Class II.
2. Epoxy Coated: ASTM A775/A775M.

C. Plain Wire: ASTM A82; plain unless either of the following finishes are noted on Drawings:
   1. Galvanized: ASTM A641/A641M.
   2. Epoxy Coated: ASTM A884/A884M.

D. Welded Plain Wire Fabric: ASTM A185/A185M; in coiled rolls; plain unless either of the following finishes are noted on Drawings:
   1. Galvanized: ASTM A641/A641M.
   2. Epoxy Coated: ASTM A884/A884M.

E. Welded Deformed Wire Fabric: ASTM A497/A497M; in coiled rolls; plain unless either of the following finishes are noted on Drawings:
   1. Galvanized: ASTM A641/A641M.
   2. Epoxy Coated: ASTM A884/A884M.

2.2 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16-gauge annealed type or epoxy coated as noted on Drawings.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions. Where applicable, provide load-bearing pad on bottom to prevent vapor retarder puncture.

C. Special Chairs, Bolsters, Bar Supports, and Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic-coated steel or stainless steel type; size and shape as required to meet Project conditions.

D. Reinforcing Splicing Devices:
   1. Manufacturer:
      b. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
   2. Description: Exothermic welding type; full tension and compression; sized to fit joined reinforcing.

E. Epoxy Coating Patching Material: Type as recommended by coating manufacturer.

2.3 FABRICATION

A. Fabricate concrete reinforcement in accordance with NJDOT (roadways, driveways and sidewalks/plazas) or ACI 318 (platforms and building structures).

B. Form standard hooks for 180 degree bends, 90 degree bend, stirrup and tie hooks, and seismic hooks as indicated on Drawings.
C. Form reinforcement bends with minimum diameters in accordance with ACI 318.

D. Fabricate column reinforcement with offset bends at reinforcement splices.

E. Form spiral column reinforcement from minimum 3/8-inch diameter continuous plain or deformed bar or wire, as indicated on Drawings.

F. Form ties and stirrups from the following:
   1. For bars No. 10 and Smaller: No. 3 deformed bars.
   2. For bars No. 11 and Larger: No. 4 deformed bars.

G. Weld reinforcement in accordance with AWS D1.4.

H. Galvanized and/or Epoxy-Coated Reinforcement: Clean surfaces, weld and re-protect welded joint in accordance with NJDOT (roadways, driveways and sidewalks/plazas) or CRSI (platforms and building structures).

I. Locate reinforcement splices not indicated on Drawings, at point of minimum stress. Review location of splices with Engineer.

2.4 SHOP FINISHING

A. Galvanized Finish for Steel Bars: ASTM A767/A767M, Class I, hot dip galvanized after fabrication.


C. Epoxy Coated Finish for Steel Bars: ASTM A775/A775M, minimum 10 mil thickness (+/- 2 mils tolerance).

D. Epoxy Coated Finish for Steel Wire: ASTM A884/A884M; Class A using ASTM A775/A775M.

2.5 SOURCE QUALITY CONTROL

A. Make completed reinforcement available for inspection at manufacturer’s factory prior to packaging for shipment. Notify Engineer at least seven days before inspection is allowed.

PART 3 EXECUTION

3.1 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position beyond specified tolerance. Do not weld crossing reinforcement bars for assembly except as permitted by Engineer.
B. Do not displace or damage vapor retarder.

C. Accommodate placement of formed openings.

D. Space reinforcement bars with minimum clear spacing in accordance with NJDOT (roadways, driveways and sidewalks/plazas) or ACI 318 (platforms and building structures). Where bars are indicated in multiple layers, place upper bars directly above lower bars.

E. Maintain concrete cover around reinforcement in accordance with ACI 318 as follows:

<table>
<thead>
<tr>
<th>Reinforcement Location</th>
<th>Minimum Concrete Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Footings and Concrete Formed Against Earth</td>
<td>3 inches</td>
</tr>
<tr>
<td>Concrete exposed to earth or weather</td>
<td></td>
</tr>
<tr>
<td>No. 6 bars and larger</td>
<td>2 inches</td>
</tr>
<tr>
<td>No. 5 bars and smaller</td>
<td>1½ inches</td>
</tr>
<tr>
<td>Supported Slabs, Walls, and Joists</td>
<td></td>
</tr>
<tr>
<td>No. 14 bars and larger</td>
<td>1½ inches</td>
</tr>
<tr>
<td>No. 11 bars and smaller</td>
<td>¾ inch</td>
</tr>
<tr>
<td>Beams and Columns</td>
<td>1½ inches</td>
</tr>
<tr>
<td>Shell and Folded Plate Members</td>
<td></td>
</tr>
<tr>
<td>No. 6 bars and larger</td>
<td>¾ inch</td>
</tr>
<tr>
<td>No. 5 bars and smaller</td>
<td>½ inch</td>
</tr>
</tbody>
</table>

F. Provide the following minimum concrete cover over reinforcement when required by code for fire resistive construction:

<table>
<thead>
<tr>
<th>Structural Member Containing Reinforcement</th>
<th>Minimum Concrete Cover Over Reinforcement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4-Hour Rating</td>
</tr>
<tr>
<td>Roof and Floor Slabs</td>
<td>1¼ inches</td>
</tr>
<tr>
<td>Beams, Girders and Trusses</td>
<td>2 inches</td>
</tr>
<tr>
<td>Joists</td>
<td>1¾ inches</td>
</tr>
</tbody>
</table>
G. Splice reinforcing where indicated on Drawings in accordance with splicing device manufacturer’s instructions.

H. Bond and ground reinforcement in accordance with requirements of Section 16060.

3.2 ERECTION TOLERANCES

<table>
<thead>
<tr>
<th>Reinforcement Depth</th>
<th>Depth Tolerance</th>
<th>Concrete Cover Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater than 8 inches</td>
<td>Plus or minus 3/8 inch</td>
<td>Minus 3/8 inch</td>
</tr>
<tr>
<td>Less than 8 inches</td>
<td>Plus or minus 1/2 inch</td>
<td>Minus 1/2 inch</td>
</tr>
</tbody>
</table>

3.3 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with ACI 318.

B. Provide free access to Work and cooperate with appointed firm.

C. Reinforcement Inspection:
   1. Placement Acceptance: Specified and ACI 318 material requirements and specified placement tolerances.
   3. Periodic Placement Inspection: Inspect for correct materials, fabrication, sizes, locations, spacing, concrete cover, and splicing.
   4. Weldability Inspection: Inspect for reinforcement weldability when formed from steel other than ASTM A706/A706M.
   5. Continuous Weld Inspection: Inspect reinforcement as required by ACI 318.
   6. Periodic Weld Inspection: Other welded connections.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item CONCRETE.

END OF SECTION
SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete for the following:
   1. Building frame members.
   2. Shear walls.
   3. Elevator shaft walls.
   4. Foundation walls.
   5. Supported slabs.
   6. Slabs on grade.
   7. Control, expansion and contraction joint devices.
   8. Equipment pads.

B. Related Sections:
   1. Section 03100 - Concrete Forms and Accessories: Formwork and accessories.
   2. Section 03200 - Concrete Reinforcement.
   3. Section 05810 - Expansion Joint Cover Assemblies.
   4. Section 07900 - Joint Sealers.

1.2 REFERENCES

A. American Concrete Institute:
   1. ACI 305 - Hot Weather Concreting.
   4. ACI 318 - Building Code Requirements for Structural Concrete.

B. ASTM International:
   1. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   4. ASTM C42/C42M - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
   8. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
15. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
18. ASTM C1218 - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
22. ASTM E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
23. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

C. New Jersey Department of Transportation:
1. NJDOT - 2001 Standard Specifications for Road and Bridge Construction.

1.3 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Product Data: Submit data on joint devices, attachment accessories and admixtures.

C. Design Data:
1. Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:
   a. Hot and cold weather concrete work.
   b. Air entrained concrete work.
2. Identify mix ingredients and proportions, including admixtures.
3. Identify chloride content of admixtures and whether or not chloride was added during manufacture.
D. Delivery Tickets:
   1. Submit for each load of concrete from the batch plant:
      a. Include batch ticket information specified in ASTM C94.
      b. Provide time and place of pour, signed by Contractor’s representative.

E. Pour Schedule: Submit schedule indicating construction methods, construction joint locations, and pour sequence locations a minimum of ten (10) days prior to commencing concrete placement.

F. Samples: Submit two (2) samples of expansion/contraction joint materials.

G. Manufacturer’s Installation Instructions: Submit installation procedures and interface required with adjacent Work.

1.4 CLOSEOUT SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Project Record Documents: Accurately record actual locations of embedded utilities and components concealed from view in finished construction.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 318.

B. Conform to ACI 305 when concreting during hot weather.

C. Conform to ACI 306.1 when concreting during cold weather.

D. Acquire cement and aggregate from one source for Work.

1.6 MOCKUP

A. Not Required.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain concrete temperature after installation at minimum 50 degrees F for minimum 7 days.

B. Maintain high early strength concrete temperature after installation at minimum 50 degrees F for minimum 3 days.
PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I - Normal Portland type; single manufacturing source.

B. Aggregates
   1. Normal Weight Concrete: ASTM C33.

C. Water: ACI 318; clean and potable, without deleterious amounts of chloride ions.

2.2 ADMIXTURES

A. Manufacturers:
   1. Sika Corp.
   2. BASF Construction Chemicals, LLC.
   4. Euclid Chemical Co.
   5. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Air Entrainment: ASTM C260.

C. Chemical Admixtures: ASTM C494/C494M; chloride free; use as directed; ensure compatibility of admixtures.
   1. Water Reducing: Type A.
   2. Water Reducing and Retarding: Type D.
   3. Water Reducing and Accelerating: Type E.
   4. Water Reducing, High Range: Type F.

D. Silica Fume: ASTM C1240; Use only as indicated; use as additive to, not replacement for, Portland cement. Provide plasticizer as required.

E. Plasticizer: ASTM C1017/C1017M; Use as indicated.
   1. Type I, plasticizing.
   2. Type II, plasticizing and retarding.

F. The following additives are not permitted:
   1. Fly ash.
   2. Calcium chloride.
   3. Slag.

2.3 ACCESSORIES

A. Bonding Agent:
   1. Manufacturers:
      a. Sika Corp., “Sikadur 32 Hi-Mod.”
b. Euclid Chemical Co., “EUCO 452.”
c. Tamms Industries, “Duralbond.”
e. f. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

2. Description: ASTM C881; Two-component, 100% solids, high modulus, moisture-tolerant structural epoxy adhesive.

B. Vapor Retarder:
1. Manufacturers:
   c. Insulation Solutions, Inc., “Viper VaporCheck.”
   f. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

2. Description: ASTM E1745, Class A; minimum 10 mil thick polyethylene film, 0.05 perms maximum permeance; type recommended for below grade application. Furnish joint tape recommended by manufacturer.

C. Non-Shrink Grout:
1. Manufacturers:
   b. Euclid Chemical Co., “EUCO Pre-Cast.”
   c. Tamms Industries, “TammsGrout Supreme.”
   d. Quikrete Co., “Fastset 1585-09.”
   f. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

2. Description: ASTM C1107, Grades B and C; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 4,000 psi in 24 hours and 6,500 psi in 28 days.

2.4 JOINT FILLERS

A. Joint Filler - Type A:
1. Manufacturers:
   a. APS Supply Co., “A.P.S. Fiber Board.”
   b. Tamms Industries, “TammsBoard.”
   d. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

2. Description: ASTM D1751; Asphalt impregnated fiberboard or felt, ½-inch thick; tongue and groove profile; with recovery rate of minimum 75 percent.
B. Joint Filler - Type B:
   1. Manufacturers:
      b. Tamms Industries, “HornFoam.”
      d. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
   2. Description: ASTM D1752; Closed cell polyethylene foam, resiliency recovery of 95 percent if not compressed more than 50 percent of original thickness.

C. Joint Filler - Type C:
   1. Manufacturers:
      a. APS Supply Co., “A.P.S. Closed Cell Neoprene.”
      b. Tamms Industries, “NeoFoam.”
      d. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
   2. Description: ASTM D1752 or ASTM D1056; Premolded sponge rubber fully compressible with recovery rate of minimum 95 percent.

D. Sealant:
   1. Manufacturers:
      a. Sika Corp., “Sikadur 51 SL.”
      b. Tamms Industries, “TammsFlex SL.”
      d. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
   2. Description: ASTM C920; two-part, cold applied, self-leveling.

2.5 CONCRETE MIX

A. Select proportions for concrete in accordance with ACI 318 based on trial mixtures or field experience. Unless otherwise indicated or required by project conditions, provide concrete to the following criteria:

<table>
<thead>
<tr>
<th>Material and Property</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Station Platforms, Foundation</td>
</tr>
<tr>
<td>Compressive Strength (28 day)</td>
<td>4,000 psi</td>
</tr>
<tr>
<td>Cement Type</td>
<td>ASTM C150</td>
</tr>
<tr>
<td>Cement Content (minimum)</td>
<td>564 lbs./cu. yd.</td>
</tr>
<tr>
<td>Aggregate Type</td>
<td>Normal weight, unless otherwise indicated</td>
</tr>
<tr>
<td>Maximum Water-Cement Ratio</td>
<td>0.35 by weight</td>
</tr>
<tr>
<td>----------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Maximum Aggregate Size</td>
<td></td>
</tr>
<tr>
<td>▪ One-fifth narrowest dimension between sides of forms within which concrete is cast</td>
<td></td>
</tr>
<tr>
<td>▪ Three-fourths of the minimum clear spacing between reinforcing bars or between reinforcing bars and forms</td>
<td></td>
</tr>
<tr>
<td>▪ One-third the slab thickness for unreinforced slabs</td>
<td></td>
</tr>
<tr>
<td>Air Content:</td>
<td></td>
</tr>
<tr>
<td>▪ Aggregate Sized to 2½”</td>
<td>5% +/- 1%</td>
</tr>
<tr>
<td>▪ Aggregate Sized to 1”</td>
<td>6% +/- 1%</td>
</tr>
<tr>
<td>▪ Aggregate Sized to ½”</td>
<td>7½ % +/- 1%</td>
</tr>
<tr>
<td>Maximum Silica Fume Content:</td>
<td>10% of Portland cement by weight</td>
</tr>
<tr>
<td>Slump:</td>
<td></td>
</tr>
<tr>
<td>▪ Maximum</td>
<td>4 inches</td>
</tr>
<tr>
<td>▪ Minimum</td>
<td>3 inches</td>
</tr>
</tbody>
</table>

B. Admixtures: Include admixture types and quantities indicated in concrete mix designs only when approved by Engineer.
1. Unless high temperatures or other placing conditions dictate, use Type A water-reducing admixture for all concrete mixes. Where use of superplasticizers is necessary, substitute Type F high range water-reducing admixture.
2. Use Type E water reducing and accelerating admixtures in cold weather. Admixture use will not relax cold weather placement requirements. Do not use calcium chloride or admixtures containing calcium chloride.
3. Use Type D water reducing and set retarding admixtures during hot weather.
4. Add air entrainment admixture to concrete mix for work exposed to freezing and thawing or deicing chemicals.
5. For concrete exposed to deicing chemicals, limit silica fume content as required by ACI 318.

C. Average Compressive Strength Reduction: Permitted in accordance with ACI 318.

D. Ready Mixed Concrete: Mix and deliver concrete in accordance with ASTM C94/C94M.

E. Site Mixed Concrete: Mix concrete in accordance with ACI 318.
PART 3 EXECUTION

3.1 EXAMINATION
   A. Verify requirements for concrete cover over reinforcement.
   B. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 PREPARATION
   A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Remove laitance, coatings, and unsound materials.
   B. 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.
   C. Remove debris and ice from formwork, reinforcement, and concrete substrates.
   D. Remove water from areas receiving concrete before concrete is placed.

3.3 PLACING CONCRETE
   A. Place concrete in accordance with ACI 318.
   B. Notify testing laboratory and Construction Manager minimum 24 hours prior to commencement of operations.
   C. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints, and other buried utilities are not disturbed during concrete placement.
   D. Install vapor retarder under interior slabs on grade in accordance with ASTM E1643. Lap joints minimum 6 inches and seal watertight using means recommended by vapor barrier manufacturer.
   E. Repair vapor barrier damaged during placement of concrete reinforcing. Repair with vapor barrier material; lap over damaged areas minimum 6 inches and seal watertight.
   F. Separate slabs on grade from vertical surfaces with ½-inch thick joint filler.
   G. Place joint filler in concrete slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
   H. Extend joint filler from bottom of slab to within ½-inch of finished slab surface. Conform to Section 07900 for finish joint sealer requirements.
I. Deposit concrete at final position. Prevent segregation of mix.

J. Place concrete in continuous operation for each panel or section determined by predetermined joints.

K. Consolidate concrete.

L. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

M. Place concrete continuously between predetermined expansion, control, and construction joints.

N. Do not interrupt successive placement; do not permit cold joints to occur unless approved by Engineer.

O. Place floor slabs in checkerboard or saw cut pattern indicated.

P. Saw cut joints within 12 hours after placing. Use 3/16 inch thick blade, cut into ¼ depth of slab thickness.

Q. Screed floors, platforms and slabs on grade level, maintaining surface flatness of maximum ⅛-inch in 10 ft, unless otherwise indicated.

3.4 SEPARATE FLOOR TOPPINGS

A. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.

B. Place required dividers, edge strips, reinforcing, and other items indicated to be cast in.

C. Apply bonding agent to substrate.

D. Place concrete floor toppings to required lines and levels. Place topping in checkerboard panels, dimension not to exceed 20 ft. square unless otherwise indicated.

E. Screed toppings level, maintaining surface flatness of maximum ¼-inch in 10 ft.

3.5 CONCRETE FINISHING

A. Provide formed concrete surfaces to be left exposed with smooth rubbed finish, unless otherwise indicated.

B. Finish concrete floor surfaces in accordance with ACI 318.

C. Steel trowel surfaces that are indicated to be exposed.
D. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains as indicated on drawings.

3.6 CURING AND PROTECTION

A. 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. Cure concrete in accordance with ACI 308.1 using curing compound method.

D. Ponding: Maintain 100 percent coverage of water over floor slab areas continuously for 7 days.

E. Spraying: Spray water over floor slab areas and maintain wet for 7 days.

3.7 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with NJUCC Building Subcode and ACI 318.

B. Provide free access to Work and cooperate with appointed firm.

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

D. Concrete Inspections:
   1. Continuous Placement Inspection: Inspect for proper installation procedures.
   2. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.

E. Strength Test Samples:
   3. Sample concrete and make one set of three cylinders for every 75 cu. yds. or less of each class of concrete placed each day; and, for every 5,000 sf of surface area for slabs and walls.
   4. When volume of concrete for any class of concrete would provide less than 5 sets of cylinders, take samples from five randomly selected batches, or from every batch when less than 5 batches are used.
   5. Make one additional cylinder during cold weather concreting, and field cure.

F. Field Testing:
1. Slump Test Method: ASTM C143/C143M.
2. Air Content Test Method: ASTM C173/C173M.
3. Temperature Test Method: ASTM C1064/C1064M.
4. Measure slump and temperature for each compressive strength concrete sample.
5. Measure air content in air entrained concrete for each compressive strength concrete sample.

G. Cylinder Compressive Strength Testing:
   2. Test Acceptance: In accordance with ACI 318.
   3. Test one cylinder at 7 days.
   4. Test two cylinders at 28 days.
   5. Retain one cylinder for 60 days for testing when requested by Architect/Engineer.
   6. Dispose remaining cylinders when testing is not required.

H. Core Compressive Strength Testing:
   1. Sampling and Testing Procedures: ASTM C42/C42M.
   2. Test Acceptance: In accordance with ACI 318.
   3. Drill three cores for each failed strength test from concrete represented by failed strength test.

I. Water Soluble Chloride Ion Concentration Test Method: ASTM C1218; tested at 28 days.
   1. Maximum Concentration: As permitted by NJUCC Building Subcode.

J. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.

3.8 PATCHING

A. Allow Construction Manager to inspect concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Construction Manager upon discovery.

C. Patch imperfections as directed by Construction Manager in accordance with ACI 318.

3.9 DEFECTIVE CONCRETE

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

B. Repair or replacement of defective concrete will be determined by Architect/Engineer and Construction Manager.
C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Construction Manager for each individual area.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item CONCRETE.
SECTION 03600
GROUT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Portland cement grout.
   2. Rapid curing epoxy grout.
   3. Non-shrink cementitious grout.

B. Related Sections:
   1. Section 03300 - Cast-in-Place Concrete.

1.2 REFERENCES

A. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.
   2. ACI 318 - Building Code Requirements for Structural Concrete.

B. American Society of Testing and Materials:
   2. ASTM C40 - Test Method for Organic Impurities in Fine Aggregates for Concrete.
   8. ASTM C827 - Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.

1.3 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Product Data: Submit product data on grout and curing compounds.
C. Manufacturer's Installation Instructions: Submit manufacturer’s instructions for mixing, handling, surface preparation and placing epoxy type and non-shrink type grouts.

D. Manufacturer’s Certificate: Certify Products meet or exceed specified requirements.

E. Submit samples of existing grout and new grout to match for architects review and approval.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.

B. Deliver grout in manufacturer's unopened containers with proper labels intact.

C. Store grout in a dry shelter, protect from moisture.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not perform grouting if temperatures exceed 90°F.

B. Maintain minimum temperature of 50°F before, during, and after grouting, until grout has set.

PART 2 PRODUCTS

2.1 PORTLAND CEMENT GROUT MATERIALS

A. Portland Cement: ASTM C150, Type I - Normal Portland type; single manufacturing source.

B. Water:
   1. Potable; containing no impurities, suspended particles, algae or dissolved natural salts in quantities capable of causing:
      b. Volume change increasing shrinkage cracking.
      c. Efflorescence.
      d. Excess air entraining.

C. Fine Aggregate:
   1. Washed natural sand.
   2. Gradation in accordance with ASTM C33 and represented by smooth granulometric curve within required limits.
   3. Free from injurious amounts of organic impurities as determined by ASTM C40.
D. Mix:
1. Portland cement, sand and water. Do not use ferrous aggregate or staining ingredients in grout mixes.

E. Grout color to match existing masonry grout.

2.2 RAPID CURING EPOXY GROUT

A. Manufacturers:
   2. Euclid Chemical Co., “E³-HP.”
   4. CTS Cement Mfg. Corp., RapidSet “.”
   5. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Rapid Curing Epoxy Grout: High strength, non-shrink three component epoxy grout formulated with thermosetting resins and inert fillers. Rapid-curing, high adhesion, and resistant to ordinary chemicals, acids and alkalies; capable of developing minimum compressive strength of 10,000 psi in 24 hours and 14,500 psi in 7 days.

2.3 NON-SHRINK CEMENTITIOUS GROUT

A. Manufacturers:
   2. Euclid Chemical Co., “EUCO Pre-Cast.”
   5. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Description: ASTM C1107, Grades B and C; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 4,000 psi in 24 hours and 6,500 psi in 28 days.

2.4 FORMWORK

A. Section 03100-Concrete Forms and Accessories: Refer to this section for formwork requirements.

2.5 CURING

A. Prevent rapid loss of water from grout during first 48 hours by use of approved membrane curing compound or with use of wet burlap method.
PART 3 EXECUTION

3.1 EXAMINATION
A. Verify areas to receive grout.

3.2 PREPARATION
A. Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by brushing, hammering, chipping or other similar means until sound, clean concrete surface is achieved.
B. Rough concrete lightly, but not enough to interfere with placement of grout.
C. Remove foreign materials from metal surfaces in contact with grout.
D. Align, level and maintain final positioning of components to be grouted.
E. Saturate concrete surfaces with clean water; remove excess water, leave none standing.

3.3 INSTALLATION - FORMWORK
A. Construct leakproof forms anchored and shored to withstand grout pressures.
B. Install formwork with clearances to permit proper placement of grout.

3.4 MIXING
A. Portland Cement Grout:
   1. Use proportions of 2 parts sand and 1 part cement, measured by volume.
   2. Prepare grout with water to obtain consistency to permit placing and packing.
   3. Mix water and grout in two steps; pre-mix using approximately 2/3 of water; after partial mixing, add remaining water to bring mix to desired placement consistency and continue mixing 2 to 3 minutes.
   4. Mix only quantities of grout capable of being placed within 30 minutes after mixing.
   5. Do not add additional water after grout has been mixed.
   6. Capable of developing minimum compressive strength of 2400 psi in 48 hours and 7000psi in 28 days.

   ***** [OR] *****

B. Mix and prepare non-shrink cementitious grout in accordance with manufacturer's instructions.
   1. Capable of developing minimum compressive strength of 4,000 psi in 24 hours and 6,500 psi in 28 days.
C. Mix grout components in proximity to work area and transport mixture quickly and in manner not permitting segregation of materials.

3.5 PLACING GROUT

A. Place grout material quickly and continuously.

B. Do not use pneumatic-pressure or dry-packing methods.

C. Apply grout from one side only to avoid entrapping air.

D. Do not vibrate placed grout mixture, or permit placement when area is being vibrated by nearby equipment.

E. Thoroughly compact final installation and eliminate air pockets.

F. Do not remove leveling shims for at least 48 hours after grout has been placed.

3.6 CURING

A. Immediately after placement, protect grout from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. After grout has attained its initial set, keep damp for minimum of 3 days.

3.7 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed in accordance with ACI 318.

B. Submit proposed mix design [of each class of grout] to [inspection and] testing firm for review prior to commencement of Work.

C. Tests of grout components may be performed to ensure conformance with specified requirements.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item for Division 3.

END OF SECTION
SECTION 04065

MASSONRY MORTAR AND GROUT

PART 1 GENERAL

1.1 SUMMARY

A. Section includes mortar and grout for masonry.

B. Related Sections:
   1. Section 04810 - Unit Masonry Assemblies: Installation of mortar and grout.
   2. Section 08115 - Standard Steel Frames: Grouting steel door frames.

1.2 REFERENCES

A. ASTM International:

B. The Masonry Society:
   1. TMS MSJC - Building Code for Masonry Structures (ACI 530/ASCE 5/TMS 402), Specification for Masonry Structures (ACI 530.1/ASCE 6/TMS 602) and Commentaries.

1.3 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

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

C. Design Data: Submit design mix when Property specification of ASTM C270 is to be used, required environmental conditions, and admixture limitations.
D. Test Reports:
1. Submit reports on mortar indicating conformance of mortar to property requirements of ASTM C270.
2. Submit reports on grout indicating conformance of grout to property requirements of ASTM C476.

E. Manufacturer's Installation Instructions: Submit premix mortar manufacturer's installation instructions.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE
A. Perform Work in accordance with TMS MSJC Code and TMS MSJC Specification.

1.5 ENVIRONMENTAL REQUIREMENTS

PART 2 PRODUCTS

2.1 MORTAR AND MASONRY GROUT
A. Portland Cement: ASTM C150, Type I, gray color.
B. Mortar Aggregate: ASTM C144, standard masonry type.
C. Hydrated Lime: ASTM C207, Type S.
D. Grout Aggregate: ASTM C404, fine and coarse.
E. Water: Clean and potable.
F. Mortar Color: Natural and synthetic iron and chromium oxide pigments, compounded for use in mortar mixes.
G. Calcium Chloride: Not permitted.

2.2 MIXES
A. Mortar Mixes:
   1. Mortar For Non-Structural Masonry: ASTM C270, Type N using Proportion specification.

B. Mortar Mixing:
1. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.
2. Achieve uniformly damp sand immediately before mixing process.
3. Add mortar color to achieve uniformity of mix and coloration. Do not exceed pigment-to-cement ratio of 1:10 by weight.
4. Re-temper only within two hours of mixing.

C. Grout Mixes:
   1. Grout for Masonry: 2,000 psi strength at 28 days; 8-11 inches slump; mixed in accordance with ASTM C476.
   2. Application:
      a. Coarse Grout: For grouting spaces with minimum 4 inches dimension in every direction.
      b. Fine Grout: For grouting other spaces.

D. Grout Mixing:
   1. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476.
   2. Add admixtures; mix uniformly.

PART 3 EXECUTION

3.1 EXAMINATION
   A. Request inspection of spaces to be grouted.

3.2 PREPARATION
   A. Apply bonding agent to existing concrete surfaces.

3.3 INSTALLATION
   A. Install mortar and grout in accordance with TMS MSJC Specification.

3.4 FIELD QUALITY CONTROL
   A. Establishing Mortar Mix: In accordance with ASTM C270.
   B. Testing of Grout Mix: In accordance with ASTM C1019 for compressive strength, and in accordance with ASTM C143/C143M for slump.
   C. Test flexural bond strength of mortar and masonry units to ASTM C1357; test in conjunction with masonry unit sections specified.
   D. Test compressive strength of mortar and masonry to ASTM C1314; test in accordance with masonry unit sections specified.
PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item MASONRY.

END OF SECTION
SECTION 04720
CAST STONE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes
   1. Cast stone sills and lintels.
   2. Anchors and supports.

B. Related Sections:
   1. Section 03300 - Cast-In-Place Concrete: Backup for cast stone veneer.
   2. Section 04065 - Masonry Mortar and Grout: Mortar for setting cast stone units.
   3. Section 04810 - Unit Masonry Assemblies: Backup for cast stone veneer.
   4. Section 04900 - Masonry Restoration and Cleaning.
   5. Section 05500 - Metal Fabrications: Shelf angles and supports and metal fabricated items for building into cast stone.

1.2 REFERENCES

A. American Society of Civil Engineers:

B. ASTM International:
   3. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   4. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   9. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

C. The Masonry Society:
   1. TMS MSJC - Building Code for Masonry Structures (ACI 530/ASCE 5/TMS 402), Specification for Masonry Structures (ACI 530.1/ASCE 6/TMS 602) and Commentaries.

1.3 DESIGN REQUIREMENTS

A. Wind Loads: Design anchors to withstand positive and negative wind loads acting normal to plane of wall, including increased loads at building corners as required by NJUCC Building Subcode (2015 ICC International Building Code, as amended); and ASCE 7.

B. Design anchor attachment to cast stone with factor of safety of 5: 1.

C. Design each individual anchor with factor of safety in vertical dead-load-bearing direction of 4: 1 and in horizontal lateral-load-bearing direction of 2: 1.

D. Design lintels to resist live and dead loads with 1/360 maximum deflection.
   1. Live Loads: As indicated on Drawings.
   2. Dead Loads: Actual weight of materials incorporated into Work.

1.4 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Shop Drawings:
   1. Indicate cast stone layout, profiles, cross-sections, reinforcement, exposed faces, joint arrangement, anchoring methods, anchors.
   2. Indicate cast stone types and location.

C. Product Data: Submit data for cast stone units, wall ties, anchors and other accessories.

D. Samples:
   1. Submit two of each cast stone item, 6 x 6 inches in size, illustrating profiles, finish, texture and color range.
   2. Submit two of each anchor illustrating material, configuration, and finish.

E. Design Data: Submit design calculations for anchors and lintels.
F. Test Reports: Indicate concrete mix design compressive strength and water absorption.

G. Manufacturer's Installation Instructions: Submit instructions for anchor attachment, cast stone cleaning, and special Project installation conditions.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with TMS MSJC Code and TMS MSJC Specification.


1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

C. Design of anchors and connections is to be done by a Professional Engineer experienced in design of this Work and licensed in State of New Jersey; Engineer is to submit signed/sealed drawings and signed/sealed calculations.

1.7 MOCKUP

Not used.

1.8 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.

B. Accept cast stone on site in manufacturer’s protective packaging. Inspect for damage.

C. Store cast stone on site covered and elevated above grade. Protect cast stone from damage, soiling, and staining.

D. Provide ventilation to prevent condensation from forming on cast stone.

1.10 ENVIRONMENTAL REQUIREMENTS

1.11 FIELD MEASUREMENTS
   A. Verify field measurements prior to fabrication.

1.12 COORDINATION
   A. Coordinate cast stone work with masonry work.

1.13 EXTRA MATERIALS
   Note used.

PART 2 PRODUCTS

2.1 CAST STONE
   A. Manufacturers:
      1. Russell Cast Stone
         400 Cooper Road, W. Berlin, NJ 08091, Phone: 856.753.4000
      2. Corinthian Cast Stone, Inc.
         115 Wyandanch Avenue, Wyandanch, NY 11798, Phone: 631.920.2340
      3. Substitutions: Submit requests for substitution in accordance with the
         General Provisions for Construction.
   B. Product Description: ASTM C1364, architectural cast stone units fabricated by
      dry casting methods, with fine grained texture, simulating natural cut stone.
   C. Color and Finish: To match existing stone pieces in texture, finish and color. Final selection to be made by Architect and NJT.

2.2 COMPONENTS
   A. Portland Cement: ASTM C150, Type I, white or gray.
   B. Coarse Aggregate: ASTM C 1364. Granite, quartz, or limestone
   C. Fine Aggregate: ASTM C 1364. Natural or manufactured sand.
   D. Coloring Pigments: ASTM C 1364. Inorganic Iron Oxides
   E. Chemical Admixtures: ASTM C 1364
   F. Water: Potable
2.3 ACCESSORIES

A. Anchors and Supports: Stainless steel, ASTM A666, Type 304.
   1. Sizes and Configurations: As required for vertical and horizontal support of cast stone and resisting specified loads.

B. Mortar: As specified in Section 04065.

C. Flashings: As specified in Section 04810.

D. Sealant: Type as specified in Section 07900.

E. Cleaning Solution: Non-acidic, not harmful to cast stone work or adjacent materials.

2.4 MIXES

Refer to specification section 04065 Masonry Mortar and Grout.

2.5 FABRICATION

A. Thickness: As indicated on drawings.

B. Size: As indicated on drawings.

C. Use rigid molds, constructed to maintain cast stone units uniform in shape, size, and finish.

D. Form units to length required for joint layout indicated on shop drawings. Field cutting to length is not permitted.

E. Reinforce units in accordance with ASTM C1364 for safe handling and as indicated on shop drawings to resist structural loads.
   1. Use galvanized finished reinforcing when concrete cover over reinforcing is less than 1-1/2 inches thick, including end conditions.

F. Embed anchors and other cast-in items.

G. Slope exposed top surfaces of horizontal sill and surfaces for natural wash.

H. Form drip slot in bottom surface of exterior units projecting more than 1/2 inch beyond face of wall. Size slot not less than 3/8 inch wide and 1/4 inch deep; full width of projection.

I. Curing: Cure units to develop concrete quality, and to minimize appearance blemishes including non-uniformity, staining, or surface cracking.

J. Acid etch exposed-to-view surfaces to remove cement film and achieve uniform appearance.
2.6 SOURCE QUALITY CONTROL

A. Test samples in accordance with ASTM D2244 for the following:
   1. Color Variation: In accordance with ASTM C1364.
   2. Hue Variation: In accordance with ASTM C1364.

B. Make completed cast stone available for inspection at manufacturer’s factory prior to packaging for shipment. Notify Construction Manager at least seven days before inspection is allowed.

C. Allow witnessing of factory inspections and test at manufacturer’s test facility. Notify Construction Manager at least seven days before inspections and tests are scheduled.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify field conditions are acceptable and are ready to receive work.

B. Verify items provided by other sections of work are properly sized and located.

3.2 PREPARATION

A. Coordinate installation of anchors furnished to other sections.

B. Provide for erection procedures and induced loads during erection. Furnish temporary bracing during installation. Maintain temporary bracing in place until final support is provided.

3.3 INSTALLATION

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain cast stone courses to uniform dimension. Form bed and head joints of uniform thickness.

C. Cast Stone Coursing:
   1. Joint Location: As indicated on Drawings.
   2. Joint Width: 3/8 inches or to match existing.

D. Placing And Bonding:
   1. Install anchors to support and position cast stone.
   2. Drench cast stone units with clear running water, just prior to setting.
   3. Lay cast stone units in full bed of mortar, with full head joints.
   4. Leave head and top joints in units with exposed top surfaces open to receive sealant.
5. Leave joints under [relieving] [shelf] angles open to receive sealant.
6. Fill dowel holes and anchor slots with mortar.
7. Do not shift or tap cast stone units after mortar has achieved initial set. Where adjustment is required, remove mortar and replace.
8. Rake mortar joints 3/4 inches deep for pointing. Sponge face of each stone to remove excess mortar.
10. Site cutting of cast stone units is not permitted.

E. Flashings:
   1. Extend flashings horizontally through cast stone veneer at shelf angles and lintels and turn down on outside face to form drip.
   2. Turn flashing up minimum 8” or until steel angle beyond is concealed.
   3. Lap end joints minimum 6 inches and seal watertight.
   4. Turn flashing, fold, and seal at corners, bends, and interruptions.

F. Lintels:
   1. Install loose steel then cast stone lintels over openings.
   2. Maintain minimum 4” inches bearing on both sides of opening.

G. Built-In Work:
   1. As work progresses, install built-in metal door, fabricated metal frames, window frames, and other items to be built-in work and furnished by other sections.
   2. Install built-in items plumb and level.
   4. Do not build in materials subject to deterioration.

3.4 ERECTION TOLERANCES

A. Maximum Variation of Joint Thickness: Plus 1/16-inch; minus 1/8-inch.
B. Maximum Offset From Adjacent Unit: 1/8-inch.
C. Maximum Variation from Plane of Wall: ¼-inch in 10 feet, and ½-inch in 20 feet or more.
D. Maximum Variation from Plumb: ¼-inch in each story non-cumulative; ½-inch in two stories or more.
E. Maximum Variation from Level Coursing: 1/8-inch in 3 feet; and ¼-inch in 10 feet; ½-inch in 30 feet.

3.5 CLEANING

A. Remove excess mortar and sealant as work progresses.
B. Replace defective mortar. Match adjacent work.

C. Wet cast stone. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.6 PROTECTION OF FINISHED WORK

A. Protect cast stone from contact with mortar, soil, and other materials capable of staining or discoloring cast stone.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item MASONRY.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section includes brick and concrete masonry units, reinforcement, anchorage, and accessories.

B. Related Sections:
   1. Section 04065 - Masonry Mortar and Grout: Mortar and grout.
   2. Section 05500 - Metal Fabrications: Product requirements for loose steel lintels and fabricated steel items for placement by this section.
   3. Section 07840 - Firestopping: Firestopping at penetrations of masonry work.
   4. Section 07900 - Joint Sealers: Rod and sealant at control and expansion joints.
   5. Section 08115 - Standard Steel Frames: Grouting steel door frames.

1.2 REFERENCES

A. ASTM International:
   1. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
   2. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   6. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.
   7. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units.
   8. ASTM C140 - Standard Test Methods of Sampling and Testing Concrete Masonry Units.
  10. ASTM C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale).

B. The Masonry Society:
   1. TMS MSJC - Building Code for Masonry Structures (ACI 530/ASCE 5/TMS 402).
2. TMS MSJC - Specification for Masonry Structures (ACI 530.1/ASCE 6/TMS 602) and Commentaries

1.3 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Product Data: Submit data for masonry units and accessories.

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

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with TMS MSJC Code and TMS MSJC Specification.

1.5 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.

1.8 COORDINATION

A. Coordinate masonry work with installation of window and door anchors.

PART 2 PRODUCTS

2.1 COMPONENTS

A. Hollow Load Bearing Concrete Masonry Units (CMU): ASTM C90; normal weight.

B. Face Brick: ASTM C216, Type FBS, Grade SW; color and texture to match existing conditions, final selection shall be made by Architect.

1. Brick Size and Shape: Modular Brick with Nominal size of 4 x 2-2/3 x 8 inches.
2.2 ACCESSORIES

A. Joint Reinforcement: ASTM A951; truss type; steel; 0.148 inch diameter side rods with 0.148 inch diameter cross ties; unfinished unless otherwise noted on Drawings.

B. Reinforcing Steel: ASTM A615/A615M, 60 ksi yield grade, deformed billet bars, unfinished unless otherwise noted on Drawings.

C. Anchor Rods: ASTM A307; Grade C; J-shaped or L-shaped; complete with washers and heavy hex nuts; sized for minimum 15 inch embedment; unfinished unless otherwise noted on Drawings.


E. Mortar and Grout: As specified in Section 04065.

F. Cleaning Solution: As specified in section 04900 Masonry Restoration and Cleaning. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

G. Steel Lintels: Size as indicated on Drawings, hot-dip galvanized.

2.3 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
   1. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304
   3. Stainless-Steel Bars: ASTM A 276 or ASTM a 666, Type 304.

B. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
   Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.187-inch diameter, hot-dip galvanized steel

2.4 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
   1. Copper: ASTM B 370, Temper H00, cold-rolled copper sheet, 16-oz./sq. ft. weight.
   2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
   3. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
4. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.

5. Fabricate through-wall flashing with sealant stop unless otherwise indicated. Fabricate by bending metal back on itself 3/4 inch at exterior face of wall and down into joint 1/4 inch to form a stop for retaining sealant backer rod.

2.5 MISCELLANEOUS MASONRY ACCESSORIES

1. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

2. Weep/Vent Products: Use one of the following unless otherwise indicated:
   a. Retain one or more of first six subparagraphs below; delete all if open-head joints are used for weep holes and vents.
      1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
      2. Products:
         a) Advanced Building Products Inc.; Mortar Maze weep vent.
         b) Blok-Lok Limited; Cell-Vent.
         c) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
         d) Heckmann Building Products Inc.; No. 85 Cell Vent.
         e) Hohmann & Barnard, Inc.; Quadro-Vent.
         f) Wire-Bond; Cell Vent.

3. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
   a. Provide one of the following configurations:
      1. Strips, full-depth of cavity and 10 inches high, with dovetail shaped notches 7 inches deep that prevent clogging with mortar droppings.
         a) Basis-of-Design Product: Subject to compliance with requirements, provide Keene Building Products; KeeneStone Cut or comparable product by one of the following:
            (1) Mortar Net USA, Ltd.
            (2) Or approved equal
PART 3 EXECUTION

3.1 EXAMINATION

A. Verify field conditions are acceptable and are ready to receive work.

B. Verify items provided by other sections of work are properly sized and located.

C. Verify built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

A. Direct and coordinate placement of metal anchors supplied to other sections.

B. Furnish temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent support.

3.3 INSTALLATION

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form bed and head joints of uniform thickness.

C. Coursing of Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches.

D. Coursing of Brick Units:
   1. Bond: To match existing condition
   2. Coursing: To match existing condition.
   3. Mortar Joints: To match existing condition
   4. Coursing bond, size and joint width is to be selected by Architect and NJT.

E. Placing And Bonding:
   1. Lay solid masonry units in full bed of mortar, with full head joints.
   2. Lay hollow masonry units with face shell bedding on head and bed joints.
   3. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
   4. Remove excess mortar as work progresses.
   5. Interlock intersections and external corners.
   6. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment is required, remove mortar and replace.
   7. Perform job site cutting of masonry units with proper tools to assure straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
8. Isolate masonry from vertical structural framing members with movement joint.
9. Isolate top of masonry from horizontal structural framing members and slabs or decks with compressible joint filler.

F. Joint Reinforcement And Anchorage:
1. Install horizontal joint reinforcement 16 inches oc.
2. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
3. Place joint reinforcement continuous in first and second joint below top of walls.
4. Lap joint reinforcement ends minimum 6 inches.
5. Reinforce joint corners and intersections with strap anchors 16 inches oc.
6. Embed wall ties in masonry backing to bond veneer at maximum 16 inches oc vertically and 16 inches oc horizontally. Place wall ties at maximum 8 inches oc vertically within 8 inches of jamb of wall openings.

G. Lintels:
1. Install loose steel or precast concrete lintels over openings.
2. Openings up To 42 inches Wide: Place two (2) No. 3 type M9 reinforcing bars 1-inch from bottom web.
3. Openings from 42 inches Up To 78 inches Wide: Place two (2) No. 5 type M16 reinforcing bars 1-inch from bottom web.
4. Do not splice reinforcing bars.
5. Support and secure reinforcing bars from displacement.
6. Place and consolidate grout fill without displacing reinforcing.
7. Allow masonry lintels to attain specified strength before removing temporary supports.
8. Maintain minimum 1-inch bearing on each side of opening.

H. Built-In Work:
1. As work progresses, install built-in metal door and glazed frames, fabricated metal frames, window frames, wood nailing strips, anchor bolts, plates, and other items to be built-in the work and furnished by other sections.
2. Install built-in items plumb and level.
3. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout or mortar. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
4. Do not build in materials subject to deterioration.

I. Cutting And Fitting:
1. Cut and fit for chases, pipes, conduit, sleeves, grounds, etc. Coordinate with other sections of work to provide correct size, shape, and location.
2. Obtain approval from Construction Manager prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.
3.4  ERECTION TOLERANCES

A.  Maximum Variation from Alignment of Columns: ¼-inch.

B.  Maximum Variation from Unit to Adjacent Unit: ⅛-inch.

C.  Maximum Variation from Plane of Wall: ¼-inch in 10 ft; and ½-inch in 20 ft or more.

D.  Maximum Variation from Plumb: ¼-inch per story non-cumulative; ½-inch in two stories or more.

E.  Maximum Variation from Level Coursing: ⅛-inch in 3 ft and ¼-inch in 10 ft; ½-inch in 30 ft.

F.  Maximum Variation of Joint Thickness: ⅛-inch in 3 ft.

G.  Maximum Variation from Cross Sectional Thickness of Walls: ¼-inch.

H.  Maximum Variation for Steel Reinforcement:
   1. ±⅛-inch when distance from centerline of steel to opposite face of masonry is 8 inches or less.
   2. ±1 inch when distance is between 8 and 24 inches.
   3. ±1¼-inch when distance is greater than 24 inches.
   4. ±2 inches from location along face of wall.

3.5  FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A.  Install flashing as follows unless otherwise indicated:
   1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
   2. Retain any of nine subparagraphs below and revise to suit wall configurations used. Arrangement of flashing can be communicated better by detailing on Drawings rather than by relying on any of the nine subparagraphs.
   3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under building paper or building wrap, lapping at least 4 inches.
   4. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
   5. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
6. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 07900 "Joint Sealers" for application indicated.

3.6 FIELD QUALITY CONTROL

A. Brick Units: Test each type in accordance with ASTM C67, 5 random units for each 50,000 units installed.

B. Concrete Masonry Units: Test each type in accordance with ASTM C140.

3.7 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

3.8 CLEANING

A. Remove excess mortar and mortar smears as work progresses.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.9 PROTECTION OF FINISHED WORK

A. Protect exposed external corners subject to damage.

B. Protect base of walls from mud and mortar splatter.

C. Protect masonry and other items built into masonry walls from mortar droppings and staining caused by mortar.
PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item MASONRY.

END OF SECTION
SECTION 04900
MASONRY RESTORATION AND CLEANING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes water and chemical cleaning of masonry surfaces; replacement of selected masonry units; repointing mortar joints; and repair of damaged masonry.

B. Related Sections:
   1. Section 02225 - Minor Demolition for Remodeling.
   2. Section 04065 - Masonry Mortar and Grout.
   3. Section 04810 - Unit Masonry Assemblies.
   4. Section 07900 - Joint Sealers.

1.2 REFERENCES

A. The Masonry Society:
   1. TMS MSJC - Building Code for Masonry Structures (ACI 530/ASCE 5/TMS 402), Specification for Masonry Structures (ACI 530.1/ASCE 6/TMS 602) and Commentaries.

1.3 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Shop Drawings: Indicate setting details of cut masonry, details of special shapes, and special supports for the work. Detail shoring and bracing, and temporary or permanent support.

C. Product Data: Submit data on cleaning compounds, cleaning solutions, and cleaning equipment.

D. Samples: Submit four samples of each masonry material to illustrate color, texture, and extremes of color range to match existing.

E. Manufacturer’s Installation Instructions: Submit installation procedures for products selected for use, manufacturer’s installation instructions, and perimeter conditions requiring special attention.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with TMS MSJC Code and TMS MSJC Specification.
1.5 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 MOCKUP
A. Restore and repoint a masonry wall, 8 feet long by 6 feet high, including mortar and accessories, wall openings, flashings, aging methods, and sealants.
B. Approval of mock up is required by NJT prior to commencement of work.

1.7 PRE-INSTALLATION MEETINGS
A. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.
B. Deliver masonry neatly stacked and tied on pallets. Store clear of ground with adequate waterproof covering.
C. Store [sand blasting] [acid solution] [restoration cleaner] materials in manufacturer's packaging.
D. Store mortar ingredients in manufacturer's packaging, or when delivered loose, with adequate weatherproof covering.

1.9 ENVIRONMENTAL REQUIREMENTS

1.10 SEQUENCING
A. Perform repointing after cleaning masonry surfaces.

1.11 SCHEDULING
A. Schedule cleaning and washing activities on exterior masonry surfaces in advance with Construction Manager.
PART 2 PRODUCTS

2.1 MASONRY RESTORATION AND CLEANING

A. Manufacturers:
   1. Prosoco “Sure Klean” Masonry Cleaning Product Line.
      - Vana Trol - For cleaning of new masonry surfaces and efflorescence
      - Saf Restorer – For cleaning existing masonry
      - Fast Acting Stripper- For removal of graffiti.
   2. Approved Equal.
   3. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

2.2 COMPONENTS

A. Masonry Cleaner
B. Potable Water
C. Mortar and Grout Materials: Conform to requirements of Section 04065.
D. Clay Brick: Existing modular brick

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify surfaces to be cleaned and restored are ready for work of this section.

3.2 PREPARATION

A. Protect elements surrounding work of this section from damage or disfiguration.
B. Immediately remove stains, efflorescence, or other excess resulting from work of this section.
C. Protect roof membrane and flashings from damage. Lay ½-inch plywood on roof surfaces over full extent of work area and traffic route.
D. Carefully remove and store fixtures, fittings, finishing hardware, and accessories.
E. Close off, seal, mask, and board up areas, landscaping, materials, and surfaces not receiving work of this section to protect from damage.
F. Construct dust proof and weatherproof partitions to close off occupied areas.
3.3 INSTALLATION

A. Rebuilding:
   1. Cut out damaged and deteriorated masonry with care in manner to
      prevent damage to adjacent remaining materials.
   2. Needle, shore or otherwise support structure in advance of cutting out
      units to maintain stability of remaining materials.
   3. Cut away loose or unsound adjoining masonry and mortar as indicated to
      provide firm and solid bearing for new work.
   4. Build in new masonry units following procedures for new work specified in
      Sections 04065 and 04810.
   5. Mortar Mix: Colored and proportioned to match existing work.
   6. Ensure anchors and ties.
   7. Install built in masonry work to match and align with existing, with joints
      and coursing true and level, faces plumb and in line. Build in openings,
      accessories and fittings.

B. Repointing:
   1. Cut out loose or disintegrated mortar in joints to minimum ½-inch depth or
      until sound mortar is reached.
   2. Utilize hand tools.
   3. Do not use power tools.
   4. Do not damage masonry units.
   5. When cutting is complete, remove dust and loose material with air jet.
   6. Premoisten joint and apply mortar specified in Section 04065. Pack tightly
      in maximum ¼-inch layers. Form smooth, compact joint to match existing.
   7. Moist cure for 72 hours.

C. Cleaning Existing Masonry:
   1. Cleaning Detergent: Hand wash clean modular brick type masonry
      surfaces at locations with general purpose masonry cleaner. Saturate
      masonry with clean water before and after application of cleaning
      detergents and flush loose mortar and dirt.

D. Cleaning New Masonry:
   1. Verify mortar is fully set and cured.
   2. Clean surfaces and remove large particles with wood scrapers, brass or
      nylon wire brushes.
   3. Scrub walls with general masonry type detergent solution using stiff
      brush. Thoroughly rinse and wash off cleaning solution, dirt and mortar
      crumbs using clean, pressurized water.

3.4 CLEANING

A. As work proceeds and on completion, remove excess mortar, smears, and
   droppings.

B. Clean surrounding surfaces.
PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item for Division 4.

END OF SECTION
THIS PAGE INTENTIONALLY LEFT BLANK
SECTION 05120

STRUCTURAL STEEL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Structural shapes.
   2. Channels and angles.
   3. Hollow structural sections.
   4. Structural pipe.
   5. Structural plates and bars.
   6. Fasteners, connectors, and anchors.
   7. Grout.

B. Related Sections:
   1. Section 03600 - Grout.
   2. Section 05500 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.2 REFERENCES

A. American Institute of Steel Construction:
   2. AISC 360 - Specification for Structural Steel Buildings.

B. ASTM International:
   8. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
13. ASTM E164 - Standard Practice for Ultrasonic Contact Examination of Weldments.

C. American Welding Society:
   1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
   2. AWS D1.1 - Structural Welding Code - Steel.

D. SSPC: The Society for Protective Coatings:
   1. SSPC SP 3 - Power Tool Cleaning.
   2. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).

1.3 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Shop Drawings:
   1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
   2. Connections.
   3. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

C. Mill Test Reports: Submit indicating structural strength, destructive and non-destructive test analysis.

D. Manufacturer's Mill Certificate: Certify products meet or exceed specified requirements.

E. Welders Certificates: Submit for welders employed on the Work, verifying AWS qualification within previous 12 months.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with AISC 341 and AISC 360.

1.5 QUALIFICATIONS

A. Fabricator: Company specializing in performing Work of this section with minimum three years documented experience with the following current AISC Certification:
   1. Standard Steel Building Structures (STD).
B. Erector: Company specializing in performing Work of this section with minimum three years documented experience with the following current AISC Certification:
   1. Certified Steel Erector (CSE).

C. Shop Painter: Company specializing in performing Work of this section with minimum three years documented experience.

D. Welders and Welding Procedures: AWS D.1 qualified within previous 12 months.

1.6 COORDINATION

A. Coordinate work with the following:
   1. Section 05210 for framed openings other than structural steel.
   2. Section 05500 for miscellaneous steel supports other than structural steel.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

A. Structural W-Shapes: ASTM A992/A992M.

B. Structural M-Shapes: ASTM A36/A36M.

C. Structural S-Shapes: ASTM A36/A36M.

D. Structural T-Shapes: Cut from structural W-shapes, M-shapes, or S-shapes.

E. Channels and Angles: ASTM A36/A36M.

F. Round Hollow Structural Sections: ASTM A500, Grade B.

G. Square and Rectangular Hollow Structural Sections: ASTM A500, Grade B.

H. Structural Pipe: ASTM A53/A53M, Grade B.

I. Structural Plates and Bars: ASTM A36/A36M.

J. Floor Plates: ASTM A786/A786M; diamond raised pattern.

2.2 FASTENERS, CONNECTORS, AND ANCHORS

A. Bolts: ASTM A307; Grade A or B.
   1. Finish: Hot dipped galvanized, unless otherwise indicated.

B. High Strength Bolts: ASTM A325; Type 1 or ASTM A490; Type 1.
   1. Finish: Hot dipped galvanized, unless otherwise indicated.
C. Nuts: ASTM A563 heavy hex type.
   1. Finish: Hot dipped galvanized, unless otherwise indicated.

D. Washers: ASTM F436; Type 1, circular. Furnish clipped washers where space limitations require.
   1. Finish: Hot dipped galvanized, unless otherwise indicated.

E. Anchor Rods: ASTM F1554; Grade 55, weldable.
   1. Shape: As indicated on Drawings.
   2. Plate Washers: ASTM A36/A36M.

F. Threaded Rods: ASTM A36/A36M.
   1. Finish: Hot dipped galvanized, unless otherwise indicated.

G. Forged Structural Steel Hardware:
   2. Eye Nuts and Eye Bolts: ASTM A108; Grade 1030.

2.3 WELDING MATERIALS

A. Welding Materials: AWS D1.1; type required for materials being welded.

2.4 ACCESSORIES

A. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing minimum compressive strength of 7,000 psi at 28 days. Refer to Section 03600.


2.5 FABRICATION

A. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

B. Fabricate connections for bolt, nut, and washer connectors.

C. Develop required camber for members.

2.6 FINISH

A. Prepare structural component surfaces in accordance with SSPC SP 3.

B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.
C. Galvanizing for Structural Steel Members: ASTM A123/A123M; minimum 1.2 oz/sq ft coating thickness; galvanize after fabrication.

D. Galvanizing for Fasteners, Connectors, and Anchors:
   1. Hot-Dipped Galvanizing: ASTM A153/A153M.
   2. Mechanical Galvanizing: ASTM B695; Class 50 minimum.

2.7 SOURCE QUALITY CONTROL AND TESTS

A. Shop test bolted and welded connections as specified for field quality control tests.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify bearing surfaces are at correct elevation.

C. Verify anchors rods are set in correct locations and arrangements with correct exposure for steel attachment.

3.2 PREPARATION

A. Furnish templates for installation of anchor rods and embedments in concrete and masonry work.

3.3 ERECTION

A. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in alignment until completion of erection and installation of permanent bracing.

B. Field weld components indicated on approved shop drawings.

C. Field connect members with threaded fasteners; torque to required resistance tighten to snug tight for bearing type connections.

D. Do not field cut or alter structural members without approval of Construction Manager.

E. After erection, touch up welds and abrasions to match shop finishes.

3.4 GROUT INSTALLATION

A. Shim bearing plates and equipment supports to proper elevation, snug tighten anchor bolts.
B. Fill void under bearing surface with grout. Install and pack grout to remove air pockets.

C. Moist cure grout.

D. Remove forms after grout is set. Trim grout edges to from smooth surface, splayed 45 degrees.

E. Tighten anchor bolts after grout has cured for a minimum of 3 days.

3.5 ERECTION TOLERANCES

A. Maximum Variation From Plumb: 1/4-inch per story, non-cumulative.

B. Maximum Offset From Alignment: 1/4-inch.

3.6 FIELD QUALITY CONTROL

A. Bolted Connections: Visually inspect all bolted connections in accordance with AISC specifications.

B. Welding:
   1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
   2. Visually inspect all welds.
   3. Ultrasonic Inspection: ASTM E164; perform on all full penetration welds.

C. Correct defective bolted connections and welds.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item METALS.

END OF SECTION
SECTION 05312
STEEL ROOF DECK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel roof deck and accessories.
   2. Formed steeleave strips, and miscellaneous flashing.
   3. 

B. Related Sections:
   1. Section 05120 - Structural Steel.
   2. Section 05500 – Metal Fabrication.
   3. Section 07620 – Sheet Metal Flashing and Trim.
   4. Section 07714 – Gutter and Downspouts.

1.2 REFERENCES

A. ASTM International:
   2. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   4. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

B. American Welding Society:
   1. AWS D1.1 - Structural Welding Code - Steel.

C. Steel Deck Institute:
   1. SDI 29 - Design Manual for Composite Decks, Form Decks and Roof Decks.

D. SSPC: The Society for Protective Coatings:
   1. SSPC Paint 15 - Steel Joist Shop Paint.

1.3 PERFORMANCE REQUIREMENTS

A. Design metal deck in accordance with SDI Design Manual.

B. Design deck to accommodate maximum vertical deck deflection of 1/240.
1.4 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Shop Drawings: Indicate deck plan, support locations, Projections, openings, reinforcement, pertinent details, and accessories.

C. Product Data: Submit deck profile characteristics and dimensions, structural properties, and finishes.

D. Manufacturer’s Installation Instructions: Submit manufacturer’s installation instructions.

E. Manufacturer’s Certificates: Certify Products meet or exceed specified requirements.

F. Welders Certificates: Submit for welders employed on the Work, verifying AWS qualification within previous 12 months.

1.5 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

B. Design deck layout, spans, fastening, joints, etc. under direct supervision of Professional Engineer experienced in design of this Work and licensed in the State of New Jersey.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.

B. Cut plastic wrap to encourage ventilation.

C. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturers:
   1. Nucor Corp. Vulcraft Division Model 1.5B
   2. ASC Profiles
   3. United Steel Deck Inc.
   4. Canam Steel Corp. the Canam Manac Group
   5. Roof Deck, Inc.
6. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Sheet Steel: ASTM A653/A653M, Grade 33 Structural Quality; with G90 galvanized coating conforming to ASTM A924/A924M.

C. Bearing Plates and Angles: ASTM A36/A36M steel.


E. Touch-Up Primer for Galvanized Surfaces: SSPC Paint 20 Type II - Organic.

2.2 ACCESSORIES

A. Flute Closures: Closed cell foam rubber premolded, 1 inch thick; profiled to fit tight to deck.

B. Valley Strips, Eave Strips: Fabricated of metal of same type and finish as deck.

2.3 FABRICATION

A. Metal Deck: Sheet steel, configured as follows:
   1. Span Design: double
   2. Minimum Metal Thickness Excluding Finish: [20 gage
   3. Minimum Section Properties (per foot width): S=0.234 in³/ ft________
   4. Nominal Height: [1-1/2] [inch, fluted profile to SDI [
   5. Formed Sheet Width: 36 inch
   6. Side Joints: lapped
   7. Flute Sides: plain vertical face

B. Related Deck Accessories: Metal closure strips, [cover plates,][22 gage thick [galvanized] sheet steel; of profile and size as indicated on drawings.

PART 3 Fasteners: Stainlesssteel, self tapping with sealing washer.

EXECUTION

3.1 INSTALLATION

A. Erect metal deck in accordance with SDI Manual.

B. Bear deck on steel supports with 1-1/2 [inch minimum bearing. Align and level.

C. Fasten roof deck to steel support members at ends and intermediate supports with fusion welds through weld washers or mechanical fasteners at [6 inches oc maximum, parallel with deck flute and at each [transverse flute.

D. Weld in accordance with AWS D1.1.
E. Mechanically [fasten male/female side laps at 6 inches o.c. maximum.

F. Seal deck joints, laps, ends, and penetrations with sealant to achieve permanent air seal.

G. Install 6 inch minimum wide sheet steel cover plates, of same thickness as deck, where deck changes direction. Mechanically attach at 12 inches o.c. maximum.

H. Install sheet steel closures and angle flashings to close openings between deck and walls, columns, and openings.

I. Install single row of foam flute closures above purlins and beams perpendicular to deck flutes.

J. 

K. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up prime paint.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item METALS.

END OF SECTION
SECTION 05400
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes load bearing formed steel stud exterior wall framing; and formed steel purlin framing and bridging.

B. Related Sections:
   1. Section 06114 - Wood Blocking and Curbing: Rough wood blocking.

1.2 REFERENCES

A. American Iron and Steel Institute:
   1. AISI SG-973 - Cold-Formed Steel Design Manual.

B. American Society of Civil Engineers:

C. ASTM International:
   2. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.

D. American Welding Society:
   1. AWS D1.1 - Structural Welding Code - Steel.
   2. AWS D1.3 - Structural Welding Code - Sheet Steel.

E. National Association of Architectural Metal Manufacturers:

F. Steel Stud Manufacturers Association:
   1. SSMA - Product Technical Information.

1.3 SYSTEM DESCRIPTION

A. General:
   1. Design to AISI SG-973 Cold-Formed Steel Design Manual.
   2. Design to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
   3. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
B. Floor and Roof Loads: Design to resist live and dead loads with 1/360 maximum deflection under the following loads, unless otherwise indicated on the Drawings:
1. Floor Live Loads: 100 psf.
3. Roof Snow Loads: As calculated in accordance with NJUCC Building Subcode (2006 ICC International Building Code, as amended); and ASCE 7, with 30 psf ground snow load.

C. Wind Loads: Design and size components to withstand positive and negative wind loads acting normal to plane of wall, including increased loads at building corners as required by NJUCC Building Subcode (2006 ICC International Building Code, as amended); and ASCE 7.

D. Seismic Loads: Design and size components to withstand seismic loads and sway displacement as calculated in accordance with NJUCC Building Subcode (2006 ICC International Building Code, as amended); and ASCE 7.

1.4 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Shop Drawings:
1. Indicate component details, framed openings, bearing, anchorage, loading, welds, type and location of fasteners, and accessories or items required of related Work.
2. Indicate stud, joist and purlin layouts.
3. Describe method for securing studs to tracks and for framing connections.
4. Submit calculations for loadings and stresses of fabricated structure under Professional Engineer's seal.

C. Product Data: Submit data on standard framing members; describe materials and finish, product criteria, limitations and ratings.

D. Mill Certifications: Submit mill certifications for steel delivered to site. Certify steel bare metal thickness in 0.001 inch, yield strength, tensile strength, total elongation in 2 inch or 8 inch gauge length, chemical analysis, and galvanized coating thickness.

1.5 QUALITY ASSURANCE

A. Calculate structural properties of framing members in accordance with AISI SG-973 Specification for Design of Cold-Formed Steel Structural Members.

B. Furnish framing materials in accordance with SSMA - Product Technical Information.
1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience and current membership in Steel Stud Manufacturers Association.

B. Installer: Company specializing in performing Work of this section with minimum five years documented experience.

C. Design structural elements under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of New Jersey.

D. Form, fabricate, provide, and connect components in accordance with NAAMM ML/SFA 540 - Lightweight Steel Framing Systems Manual.

PART 2 PRODUCTS

2.1 FRAMING COMPONENTS

A. Steel Sheet: ASTM A1003/A1003M; Structural Grade, Type H, metallic coated.
   1. Grade: As required by performance requirements.
   2. Coating: G60.

B. Studs: Steel sheet, formed to channel shape, solid web, knurled faces; minimum 18 gauge, with 37 ksi yield strength; face and depth determined by performance requirements specified unless otherwise noted on drawings.

C. Joists: Steel sheet, formed to shape indicated on Drawings; solid web; minimum 16 gauge, with 50 ksi yield strength; face and depth determined by performance requirements specified unless otherwise noted on drawings.

D. Purlins: Steel sheet, formed to shape indicated on Drawings; solid web; minimum 16 gauge, with 50 ksi yield strength; face and depth determined by performance requirements specified unless otherwise noted on drawings.

E. Track: Steel sheet, formed to channel shape; same gauge and width as studs, tight fit; solid web.

2.2 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined by performance requirements specified.

B. Plates, Gussets, Clips: Formed sheet steel, thickness determined by performance requirements specified.

2.3 FASTENERS
A. Self-drilling, Self-tapping Screws, Bolts, Nuts, and Washers: Steel, hot dip galvanized.
B. Anchorage Devices: Drilled expansion bolts.
C. Welding: In conformance with AWS D1.1 and AWS D1.3.

2.4 FABRICATION
A. Fabricate assemblies of formed sections of sizes and profiles required.
B. Fit, reinforce, and brace framing members to suit design requirements.
C. Fit and assemble in largest practical sections for delivery to site, ready for installation.

PART 3 EXECUTION

3.1 EXAMINATION
A. Verify building framing components are ready to receive Work.
B. Verify rough-in utilities are in proper location.

3.2 ERECTION OF STUDS
A. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 24 inches o.c.
B. Place studs at 16 inches o.c.; not more than 2 inches from abutting walls and at each side of openings. Connect studs to tracks using fastener or welding method.
C. Construct corners using minimum three studs. Double stud wall openings, door jambs, and window jambs.
D. Erect load bearing studs one piece full length. Splicing of studs is not permitted.
E. Erect load bearing studs, brace, and reinforce to develop full strength, to achieve design requirements.
F. Fully seat axial loaded studs in receiving tracks with maximum 1/16-inch gap between stud and track web.
G. Coordinate placement of insulation in multiple stud spaces after erection.
H. Install intermediate studs above and below openings to align with wall stud spacing.

I. Install studs with deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.

J. Attach cross studs or furring channels and wood blocking to studs for attachment of fixtures anchored to walls.

K. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

L. Touch-up field welds and damaged metallic coatings surfaces with primer to match shop coating.

M. Complete framing ready to receive building envelope.

3.3 ERECTION OF JOISTS AND PURLINS

A. Install framing components.

B. Make provisions for erection stresses. Install temporary bracing to maintain alignment, until permanent bracing and attachments are installed.

C. Place purlins at 24 inches o.c. unless otherwise noted on Drawings. Connect to supports using welding method.

D. Set joists parallel and level, with lateral bracing and bridging.

E. Locate joist end bearing directly over load bearing studs or install load distributing member to top of stud track.

F. Install web stiffeners at reaction points.

G. Touch-up field welds and damaged metallic coatings surfaces with primer to match shop coating.

H. Complete framing ready to receive building.

3.4 ERECTION TOLERANCES

A. Maximum Variation from Indicated Position: 1/4-inch.

B. Maximum Variation of Members from Plane: 1/4-inch.
PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item METALS.

END OF SECTION
SECTION 05500

METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes shop fabricated metal items including but not limited to: steel angles, elevator pit ladder, sump pit cover, anchors, dowels and miscellaneous steel shapes.

B. Related Sections:
   1. Section 03300 - Cast-In-Place Concrete: Execution requirements for embedded anchors and attachments for metal fabrications specified by this section in concrete.
   2. Section 05120 - Structural Steel.
   3. Section 09900 - Paints and Coatings: Field applied paint finish.

1.2 REFERENCES

A. American Architectural Manufacturers Association:

B. ASTM International:

C. American Welding Society:
1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
2. AWS D1.1 - Structural Welding Code - Steel.
3. AWS D1.3 - Structural Welding Code - Sheet Steel.
4. AWS D1.6 - Structural Welding Code - Stainless Steel.

D. National Ornamental & Miscellaneous Metals Association:
1. NOMMA Guideline 1 - Joint Finishes.

E. National Association of Architectural Metal Manufacturers:
2. Heavy Duty Metal Bar Grating Manual, (ANSI/NAAMM MBG531-09)

F. SSPC: The Society for Protective Coatings:
1. SSPC Paint 15 - Steel Joist Shop Paint.
2. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).

1.3 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders Certificates: Submit for welders employed on the Work, verifying AWS qualification within previous 12 months.

D. Submit pit ladder and guardrail re-installation shop drawings, calculations, and certifications signed and sealed by a licensed NJ professional. If the manufacturer is unable to provide signed and sealed the calculations and
drawings by a NJ Licensed Professional, then signed and sealed Drawings by a Licensed Engineer in the State of Manufacture is acceptable.

1.4 QUALITY ASSURANCE

A. Perform welding in accordance with:
   2. Sheet Steel: AWS D1.3.

B. Finish joints in accordance with NOMMA Guideline 1.

C. Perform Work in accordance with NJUCC Building Subcode.

1.5 QUALIFICATIONS

A. Design under direct supervision of Professional Engineer experienced in design of this Work and licensed in the State of New Jersey.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.

B. Accept metal fabrications on site in labeled shipments. Inspect for damage.

C. Protect metal fabrications from damage by exposure to weather.

1.7 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on shop drawings.

PART 2 PRODUCTS

2.1 MATERIALS

A. Steel Materials:
   1. Sections: ASTM A36/A36M.
   2. Plate: ASTM A36/A36M.
   3. Hollow Structural Sections: ASTM A500, Grade B.
   5. Pipe: ASTM A53/A53M, seamless, Grade B.
   6. Bolts: ASTM A307; Grade A or B.
      a. Finish: Hot dipped galvanized, unless otherwise indicated.
      a. Finish: Hot dipped galvanized, unless otherwise indicated.
   8. Washers: ASTM F436; Type 1.
a. Finish: Hot dipped galvanized, unless otherwise indicated.
9. Welding Materials: AWS D1.1; type required for materials being welded.
10. Shop and Touch-Up Primer: SSPC Paint 15, Type 1, red oxide.
11. Touch-Up Primer for Galvanized Surfaces: SSPC Paint 20, Type II Organic zinc rich.

B. Stainless Steel Materials:
   1. Bars and Shapes: ASTM A276; Type 316 and 304.

2.2 MISCELLANEOUS METAL PRODUCTS

A. Lintels: Steel sections, size and configuration as indicated on Drawings, length to allow 8 inches minimum bearing on both sides of opening.
   1. Exterior Locations: Galvanized.
   2. Interior Locations: Prime paint, one coat.

B. Structural Supports: Steel sections, shape and size as indicated on Drawings, to support applied loads with maximum deflection of 1/240 of the span; prime paint,

C. Elevator Pit Ladders:
   1. Shall be shop fabricated of hot dip galvanized ASTM A36 Steel.
   2. Steel shapes: 2"x3/8" rails and ¾" O.D. rungs
   3. Dimensions: As shown on drawings.
   4. Loads:
      a. Sustain 3.3 times intended load.
      b. 2 concentrated loads of 250lbs between 2 consecutive attachments.
      c. Each rung shall support a concentrated load of 300lbs.

D. Sump Pit Cover:
   1. Shall be fabricated of hot dip galvanized ASTM A36 Steel.
   2. Grating Dimensions: W-22-4 (1 ½" x ¼")Steel
   3. Dimensions as shown on drawings.

E. Anchor Rods: ASTM F1554; Grade 55, weldable.
   1. Shape: As indicated on Drawings.
   2. Plate Washers: ASTM A36/A36M.

2.3 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 continuous welds.
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.

2.4 FACTORY APPLIED FINISHES - STEEL

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime paint items with one coat except where galvanizing is indicated.

D. Galvanizing: ASTM A123/A123M; minimum 2.0 oz/sq ft coating thickness; galvanize after fabrication.

E. Galvanizing for Fasteners, Connectors, and Anchors:
   1. Hot-Dipped Galvanizing: ASTM A153/A153M.
   2. Mechanical Galvanizing: ASTM B695; Class 50 minimum.

2.5 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

3.1 EXAMINATION

A. Verify field conditions are acceptable and are ready to receive Work.
3.2 PREPARATION
A. Clean and strip primed steel items to bare metal and aluminum where site welding is required.
B. Supply steel items required to be cast into concrete with setting templates to appropriate sections.

3.3 INSTALLATION
A. Install items plumb and level, accurately fitted, free from distortion or defects.
B. Make provisions for erection stresses. Install temporary bracing to maintain alignment, until permanent bracing and attachments are installed.
C. Field weld components indicated on shop drawings. Perform field welding in accordance with applicable AWS code for materials being joined.
D. Obtain approval of Construction Manager prior to site cutting or making adjustments not scheduled.
E. After erection, touch up welds, abrasions, and damaged finishes with prime paint or galvanizing repair paint to match shop finishes.

3.4 ERECTION TOLERANCES
A. Maximum Variation From Plumb: 1/4-inch for every 12 feet, non-cumulative.
B. Maximum Offset From Alignment: 1/4-inch.
C. Maximum Out-of-Position: 1/4-inch.

PART 4 COMPENSATION
4.1 MEASUREMENT AND PAYMENT
A. Measurement: The work of this section shall not be measured.
B. Payment: The cost of this section shall be included in the lump sum bid item METALS.

END OF SECTION
SECTION 05810
EXPANSION JOINT ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes expansion joint assemblies for exterior surfaces at elevator platforms.

B. Related Sections:
   1. Section 03100 - Concrete Forms and Accessories: Execution requirements for placement of joint assembly frames in formwork.
   2. Section 03300 - Cast-in-Place Concrete: Expansion and contraction joints in exterior concrete joints.

1.2 REFERENCES

A. ASTM International:
   1. Tensile Strength min ASTM D412
   2. Elongation at Break ASTM D412
   3. Hardness, Shore A ASTM D2240
   4. Oven Aging, 70hrs ASTM D573
   5. Oil Swell, 70hrs ASTM D471
   6. Ozone Resistance, 70hrs ASTM D1149
   7. Low Temperature Stiffening ASTM D2240

1.3 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Shop Drawings: Indicate joint and splice locations, miters, layout of work, affected adjacent construction, and anchorage locations.

C. Product Data: Submit joint assembly profiles, profile dimensions, anchorage devices, and available colors and finishes.

D. Samples: Submit two samples, 12-inches long, illustrating profile, dimension, color, and finish selected.

E. Manufacturer's Installation Instructions: Submit rough-in sizes; provide templates for cast-in or placed frames or anchors; required tolerances for item placement.

1.4 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.
1.5 FIELD MEASUREMENTS
A. Verify field measurements are as instructed by manufacturer.

PART 2 PRODUCTS

2.1 EXPANSION JOINT ASSEMBLIES
A. Manufacturers:
   1. Watson Bowman Acme, Model “Jeene Seal” FW Series
   2. Approved Equal
   3. Substitutions: Submit requests for substitution in accordance with the
      General Provisions for Construction.

2.2 COMPONENTS
A. Air pressurized neoprene extruded expansion joint
B. Cold and warm weather adhesives adhering to ASTM:
   1. Tensile Strength ASTM D638
   2. Axial Compression ASTM D695
   3. Pot Life ASTM D2471
   4. Flash Point ASTM D56
C. Conditioning agent
D. Concrete cleaner

2.3 FABRICATION
A. Expansion joints shall be furnished in single length; splicing is not permitted.
B. Accessories for installation of expansion joint shall be provided with expansion
   joint assembly.

PART 3 EXECUTION

3.1 EXAMINATION
A. Verify joint preparation and affected dimensions are acceptable.

3.2 PREPARATION
A. Face of concrete shall be smooth and dry prior to installation of joint adhesive.
B. Provide templates and rough-in measurements.
3.3 INSTALLATION
   A. Align work plumb and level, flush with adjacent surfaces.
   B. Rigidly anchor to substrate to prevent misalignment.

3.4 PROTECTION OF INSTALLED CONSTRUCTION
   A. Do not permit traffic over unprotected floor joint surfaces.

3.5 SCHEDULES
   Not Used

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT
   A. Measurement: The work of this section shall not be measured.
   B. Payment: The cost of this section shall be included in the lump sum bid item METALS.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section includes structural plywood; roof sheathing; preservative treatment of wood; fire retardant treatment of wood; miscellaneous framing and sheathing; telephone and electrical panel back boards; and concealed wood blocking for support of wood trim and.

B. Related Sections:
   1. Section 05400 – Cold Formed Metal Framing: Cold formed metal roof joists to receive plywood sheathing.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A135.4 - Basic Hardboard.

B. American Wood-Preservers’ Association:
   1. AWPA C20 - Structural Lumber - Fire-Retardant Treatment by Pressure Processes.

C. National Institute of Standards and Technology:

D. Northeastern Lumber Manufacturers Association:
   1. NELMA - Standard Grading Rules for Northeastern Lumber.

E. National Lumber Grades Authority:
   1. NLGA - Standard Grading Rules for Canadian Lumber.

F. Southern Pine Inspection Bureau:
   1. SPIB - Standard Grading Rules for Southern Pine Lumber.
   2. WWPA G-5 - Western Lumber Grading Rules.

1.3 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.
B. Product Data: Submit technical data on insulated sheathing, wood preservative materials, and application instructions.

C. Samples of Exposed to View Wood Members: Submit two samples, 6 x 6 inch in size illustrating wood grain, stain, and finish.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the following:
   2. Wood Structural Panel Grading Agency: Certified by APA/EWA.

B. In lieu of grade stamping exposed to view lumber and wood structural panels, submit manufacturer's certificate certifying Products meet or exceed specified requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.

B. Protect trusses from warping or other distortion by stacking in vertical position, braced to resist movement.

PART 2 PRODUCTS

2.1 LUMBER MATERIALS

A. Lumber Grading Rules: EWA, NELMA and WWPA.

B. Roof curb lumber: Southern Pine

2.2 SHEATHING MATERIALS

A. Sheathing Grading Rules: APA

B. Wood Structural Panel Roof Sheathing: Exterior Plywood Grade B-C Sanded.

C. Telephone and Electrical Panel Boards: Exterior Plywood Grade C-C Sanded.

2.3 SHEATHING LOCATIONS

A. Sloped Roof Sheathing: ¾” inch thick, Span Rating 48/24, 48 x 96 inch sized sheets, square edges.

2.4 ACCESSORIES

A. Fasteners and Anchors:
1. Fasteners: Hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.

2.5 FACTORY WOOD TREATMENT

A. Wood Preservative (Pressure Treatment): AWPA Treatment C1 using water borne preservative with 0.25 percent retainage.

PART 3 EXECUTION

3.1 FRAMING

A. Curb roof openings; form corners by alternating lapping side members.

B. Coordinate curb installation with installation of decking and support of deck and parapet construction.

3.2 SHEATHING

A. Secure roof sheathing with longer edge (strength axis) perpendicular to framing members and with ends staggered and sheet ends over bearing.

B. Use sheathing clips between sheets between roof framing members.

C. Install telephone and electrical panel back boards with plywood sheathing material where required. Size back boards 12 inches beyond size of electrical panel unless otherwise dimensioned on Drawings.

3.3 TOLERANCES

A. Framing Members: ¼-inch from indicated position, maximum.

B. Surface Flatness of Floor: ¼-inch in 10 feet maximum, and ½-inch in 30 feet maximum.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item WOOD AND PLASTICS.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section includes roof curbs; blocking in wall and roof openings; concealed wood blocking for support in electrical panel back boards; and preservative treatment of wood.

1.2 REFERENCES

A. American Wood-Preservers’ Association:
   1. AWPA C1 - All Timber Products - Preservative Treatment by Pressure Process.
   2. AWPA C20 - Structural Lumber - Fire-Retardant Treatment by Pressure Processes.

B. National Institute of Standards and Technology:

1.3 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Product Data: Submit technical data on wood preservative and fire retardant treatment materials and application instructions.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the following:
   2. Plywood Grading Agency: Certified by APA/EWA.

PART 2 PRODUCTS

2.1 MATERIALS


B. Miscellaneous Curbing and Blocking: S/P/F species, exterior grade, 19 percent maximum moisture content after treatment, pressure preservative treated.

C. Plywood: APA/EWA Rated Structural I, Grade A-C; sanded; fire retardant treated.
2.2 ACCESSORIES

A. Fasteners and Anchors:
   1. Fasteners: Hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
   2. Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolted fastener for anchorages to steel.

2.3 FACTORY WOOD TREATMENT

A. Wood Preservative (Pressure Treatment): AWPA C1 using water borne preservative with 0.25 percent retainage.

B. Fire Retardant Treatment: Pressure treatment, AWPA C20 for lumber and AWPA C27 for plywood, Interior Type, chemically treated and pressure impregnated; capable of providing a maximum flame spread/smoke development rating of 25/450.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify substrate conditions are ready to receive blocking, curbing and framing.

3.2 PREPARATION

A. Coordinate placement of blocking, curbing and framing items.

3.3 INSTALLATION

A. Set members level and plumb, in correct position.

B. Place horizontal members crown side up.

C. Construct curb members of solid wood sections.

D. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.

E. Coordinate curb installation with installation of roof decking and support of deck openings.

F. Install telephone and electrical panel backboards with plywood sheathing material where required. Size back boards 12 inches beyond size of electrical and telephone panel unless otherwise noted.
3.4 SCHEDULES

A. Curbing and Blocking: S/P/F species, 19 percent maximum moisture content, pressure preservative treated.

B. Telephone and Electrical Panel Boards: 3/4 inch thick, square edges, fire retardant treated.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item WOOD AND PLASTICS.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section includes finish carpentry items such as exterior wood trim and attachment accessories.

B. Related Sections:
   1. Section 05400 – Cold Formed Metal Framing
   2. Section 06114 - Wood Blocking and Curbing.
   3. Section 09900 - Paints and Coatings:

1.2 REFERENCES

A. ASTM International:

B. Architectural Woodwork Institute:
   1. AWI - Quality Standards Illustrated.

C. Federal Specification Unit:

D. Hardwood Plywood and Veneer Association:
   1. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.

E. National Institute of Standards and Technology:

F. Woodwork Institute:

1.3 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Shop Drawings: Provide elevations with materials, component profiles, fastening methods, jointing details, and accessories to minimum scale of 1-1/2 inch to 1 foot.

C. Product Data:
1. Submit data on fire retardant treatment materials and application instructions.

D. Samples:
   1. Submit two samples of wood trim, 10 inch long.

E. Certification: Submit copy of fabricator’s authorization to use AWI Grade Stamps, AWI Quality Certification Program license and Project specific letters.

1.4 QUALITY ASSURANCE

1.5 QUALIFICATIONS
   A. Fabricator: Company specializing in fabricating Products specified in this section with minimum three years documented experience.

1.6 MOCKUP
   A. Construct mockups, full size.
   B. Locate where directed by Construction Manager.
   C. Incorporate accepted mockup as part of Work.

1.7 PRE-INSTALLATION MEETINGS
   A. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING
   A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.
   B. Protect work from moisture damage.

1.9 FIELD MEASUREMENTS
   A. Verify field measurements prior to fabrication.

1.10 SEQUENCING
   A. Sequence work to ensure utility connections are achieved in orderly and expeditious manner.
1.11 COORDINATION

A. Coordinate work with installation of associated and adjacent components, and escalator work.

PART 2 PRODUCTS

2.1 FINISH CARPENTRY

A. Manufacturers: Fabricator/Supplier of dimensional hardwood and softwood lumber, certified by the AWI.

2.2 COMPONENTS

A. Exterior Wood Trim:
   1. Hardwood Lumber: AWI Grade I maximum moisture content of 5-10 percent; and the following:
   2. Species of Wood: White Oak
   3. Cut or Slicing of Wood: Plain sliced
   4. Size and Profile: To match existing

2.3 ACCESSORIES

A. Fasteners: Of size and type to suit application; exposed finish in concealed locations and concealed finish in exposed locations.

B. Lumber for Shimming, Blocking, and furring: Softwood lumber of Pine, Southern Yellow species.

C. Paint: See painting specification 09900.

D. Sealer: See painting specification 09900.

E. Wood Filler: Oil base, tinted to match surface finish color.

2.4 FABRICATION

A. Fabricate to AWI Custom Premium standards.

B. When necessary to cut and fit on site, fabricate materials with ample allowance for cutting. Furnish trim for scribing and site cutting.

2.5 FINISHING

A. Sand work smooth and set exposed nails.

B. Apply wood filler in exposed nail indentations.
C. On items to receive transparent finishes, use wood filler matching surrounding surfaces and of types recommended for applied finishes.

D. Finish work in accordance with specification Section 09900 – Paints and Coatings, color to match existing.

PART 3 EXECUTION

3.1 EXAMINATION
   A. Verify adequacy of backing and support framing.

3.2 EXISTING WORK
   A. Modify and extend existing finish carpentry installations using materials and methods as specified.

3.3 INSTALLATION
   A. Install work in accordance with AWI Custom quality standard.
   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 components with nails at 12” inch on center.
   E. Preparation For Site Finishing:

3.4 ERECTION TOLERANCES
   A. Maximum Variation from Indicated Position: 1/16-inch.
   B. Maximum Offset from Alignment with Abutting Materials: 1/32-inch.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT
   A. Measurement: The work of this section shall not be measured.
   B. Payment: The cost of this section shall be included in the lump sum bid item WOOD AND PLASTICS.
SECTION 07550
MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes modified bitumen membrane roofing with insulation, base flashings, cant strips and counter flashing.

B. Related Sections:
   2. Section 07620 - Sheet Metal Flashing and Trim: Weather protection for base flashings.

1.2 REFERENCES

A. ASTM International:
   5. ASTM D312 - Standard Specification for Asphalt used in Roofing.

B. National Roofing Contractors Association:
   1. NRCA - The NRCA Roofing and Waterproofing Manual.

C. Underwriters Laboratories Inc.:
   1. UL - Fire Resistance Directory.

1.3 SYSTEM DESCRIPTION

A. SBS Modified Bitumen Conventional Roofing System: two-ply membrane system with insulation and impregnated mineral surface finish.

1.4 PERFORMANCE REQUIREMENTS

A. Conform to NJUCC Building Subcode 2015 ICC International Building Code, as amended for roof assembly fire hazard requirements.

B. Uplift Resistance: UL 1897; 90 psf uplift pressure resistance.
1.5 SUBMITTALS

A. Submit under the requirements of the General Provisions for Construction.

B. Shop Drawings: Indicate setting plan for tapered insulation, layout of seams, direction of laps, base flashing details.

C. Product Data: Submit membrane materials, base flashing materials and insulation.

D. Manufacturer's Installation Instructions: Submit special precautions required for seaming membrane.

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

F. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures and wind velocity during application.

1.6 QUALITY ASSURANCE


B. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience, approved by manufacturer.

1.8 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing Work of this section.

B. Review installation procedures and coordination required with related Work.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.

B. Deliver products in manufacturer's original containers, dry, undamaged, seals and labels intact.

C. Store products in weather protected environment, clear of ground and moisture.
D. Stand roll materials on end.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Do not apply roofing membrane during inclement weather or in ambient temperatures below 40°F or above 90°F without proper weather protection.

B. Do not apply roofing membrane to damp or frozen deck surface.

C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

1.11 COORDINATION

A. Coordinate Work with installing associated metal flashings as work of this section proceeds.

1.12 WARRANTY

A. Furnish twenty-year manufacturer material and labor warranty to cover failure to prevent penetration of water.

PART 2 PRODUCTS

2.1 MODIFIED BITUMINOUS ROOFING

A. Manufacturers:
   1. Henry Company, Model “modified Plus SBS Modified Bitumen Roofing”
   2. Firestone Building Products, Model “Firestone SBS”.
   3. GAF Materials Corporation, Model “Ruberoid SBS Modified Bitumen”
   4. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

2.2 COMPONENTS

A. Membrane: Asphalt and polymer modifiers of styrene-butadiene-styrene (SBS), reinforced with non-woven polyester reinforcement and granule surface; with the following characteristics:
   1. Thickness 160 mils.
   2. Sheet Width 39 3/8” inch.
   3. Tensile Strength @ 0°F, 111 psi when tested in machine direction. 93 psi when tested in cross machine direction.
   4. Elongation to Break 40% in machine and machine cross direction.

B. Base Sheet: Asphalt glass fiber base sheets.
   1. Thickness 80 mils.
C. Reinforcing Plies: Asphalt glass fiber ply sheets.
   1. Thickness 80 mils

D. Bituminous Materials:
   1. Asphalt Bitumen: ASTM D312, Type III.

E. Insulation: ASTM C578, tapered expanded polystyrene roof insulation with the
   following characteristics:
   1. Board Size: 4’x 8’
   2. Board Thickness: 1.5” minimum.
   4. Fastening: adhered as per manufacturer’s recommendation.

F. Flexible Flashings: Same material as membrane.

G. Counterflushing: painted galvanized metal, as specified in Section 07620.

2.3 ACCESSORIES

A. Wood Cant Strip and Blocking: Specified in Section 06114.

B. Insulation Joint Tape: Asphalt treated glass fiber reinforced; 6 inches wide; self
   adhering.

C. Roofing Nails: Galvanized, hot dipped or non-ferrous type, size as required to
   suit application.

D. Insulation Fasteners: As recommended by required by manufacturer.

E. Sealants: As recommended by membrane manufacturer.

F. Strip Reglet Devices: Galvanized steel mounted, binder bars, maximum possible
   length per location, with attachment flanges.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secured.

C. Verify deck is clean and smooth, free of depressions, waves, or projections,
   properly sloped to drains, valleys, or eaves.
D. Verify deck surfaces are dry and free of snow or ice. Verify flutes of metal deck are clean and dry.

E. Confirm dry deck moisture content acceptable to roofing manufacturer.

F. Verify roof openings, curbs, pipes, conduit, sleeves, ducts, and vents through roof are solidly set, and wood cant strips, wood nailing strips and reglets are in place.

3.2 PREPARATION

A. Metal Deck:
1. Prepare metal deck for installation of extruded polystyrene insulation.

3.3 APPLICATION

A. Insulation Application:
1. Apply adhesive to deck. Embed insulation into adhesive with full contact.
2. Apply adhesive to top surface of insulation. Embed second layer of insulation into adhesive, with joints staggered minimum 6 inches from joints of first layer.
3. Place tapered thickness insulation second layer to required slope pattern.
4. Mechanically fasten insulation to deck at roof perimeter.
5. Place boards at right angles to deck flutes with edges over flute surface for bearing support.
6. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
7. Lay tapered boards 18 inches back from roof drains for positive drainage.
8. Apply no more insulation than can be covered with membrane in same day.
9. Tape joints of insulation.

B. Membrane Application:
1. Apply membrane and primer.
2. Apply membrane; lap and seal edges and ends permanently waterproof.
3. Apply membrane smooth, free from air pockets, wrinkles, or tears. Ensure full bond of membrane to substrate.
4. Extend membrane up cant strips and minimum of 8 inches onto vertical surfaces.
5. Extend membrane over low parapet.
6. Mop and seal membrane around roof protrusions and penetrations.
7. Provide waterproof cut-off to membrane at end of day's operation. Remove cut-off before resuming roofing.

C. Flashings And Accessories:
1. Apply flexible sheet base flashings to seal membrane to vertical elements.
2. Secure to reglets.
3.4 FIELD QUALITY CONTROL
   A. Correct identified defects or irregularities.
   B. Require site attendance of roofing [and insulation] materials manufacturers during installation of the Work.

3.5 CLEANING
   A. 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.
   B. Repair or replace defaced or disfigured finishes caused by work of this section.

3.6 PROTECTION OF INSTALLED CONSTRUCTION
   A. Protect building surfaces against damage from roofing work.
   B. Where traffic must continue over finished roof membrane, protect surfaces.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT
   A. Measurement: The work of this section shall not be measured.
   B. Payment: The cost of this section shall be included in the lump sum bid item for DIVISION 7.

END OF SECTION
SECTION 07613
MANUFACTURED SHEET METAL ROOFING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Architectural standing seam metal roofing.
   2. Clips
   3. Flashings and trims
   4. Ridge
   5. Closures
   6. Sealants
   7. Structural supports.
   8. Underlayment.
   9. Metal gutters and downspouts.
   10. Snow guards.

B. Related Sections:
   1. Section 05400 - Cold-Formed Metal Framing: Structural framing supporting metal roofing.
   2. Section 06112 - Framing and Sheathing: Plywood roof deck substrate.
   4. Section 07620 - Sheet Metal Flashing and Trim.
   5. Section 07714 - Gutters and Downspouts.
   7. Section 15160 - Storm Drainage Piping: Connection of downspouts to storm sewer.

1.2 REFERENCES

A. American Iron and Steel Institute:
   1. AISI SG-973 - Cold-Formed Steel Design Manual.

B. American Society of Civil Engineers:

C. ASTM International:
   1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
9. UL 580 Test for Uplift Resistance of Roof Assemblies
10. UL 2218 Impact Resistance of Prepared Roof Covering Materials

D. Federal Specification Unit:
   1. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.

E. National Roofing Contractors Association:
   1. NRCA - The NRCA Roofing and Waterproofing Manual.

F. Sheet Metal and Air Conditioning Contractors:

G. Underwriters Laboratories Inc.:
   1. UL 580 - Tests for Uplift Resistance of Roof Assemblies.

1.3 DESIGN REQUIREMENTS

A. Roof Loads: Design to resist live and dead loads with 1/360 maximum deflection under the following loads, unless otherwise indicated on the Drawings:
   2. Roof Snow Loads: As calculated in accordance with NJUCC Building Subcode (2015 ICC International Building Code, as amended); and ASCE 7, with 25 psf ground snow load.
   3. Dead Loads: Actual weight of materials incorporated into Work.

B. Wind Loads: Design and size components to withstand positive and negative wind loads, including increased loads at building corners as required by NJUCC Building Subcode (2015 ICC International Building Code, as amended); and ASCE 7.

C. Wind Uplift Resistance: UL 580; Class 90.

D. Seismic Loads: Design and size components to withstand seismic loads and sway displacement as calculated in accordance with NJUCC Building Subcode (2015 ICC International Building Code, as amended); and ASCE 7.
E. Air Infiltration: Limit air leakage through roof assembly to 0.03 cfm/sq ft of wall area, measured at reference differential pressure across assembly of 6.24 psf as measured in accordance with ASTM E283.

F. Water Leakage: None, when measured in accordance with ASTM E331 with test pressure of 6.24 psf.


H. Exterior Components: Accommodate the following without damage to system, components or deterioration of seals.
   1. Movement within system.
   2. Movement between system and perimeter framing components.
   3. Dynamic loading and release of loads.
   4. Deflection of structural support framing.
   5. Expansion and contraction from temperature range of 170 degrees F over 12 hour period.

1.4 SUBMITTALS

A. Submit under the requirements of the General Provisions for Construction.

B. Shop Drawings:
   1. Indicate metal roofing profiles, jointing patterns, jointing details, fastening methods, flashings, terminations, and installation details.

C. Product Data:
   1. Submit data on metal types, finishes, and characteristics.
   2. Submit color charts for finish selection.

D. Samples:
   1. Submit two samples 6 x 6-inch in size illustrating metal roofing mounted on plywood backing illustrating typical seam, ridge, material, and finish.
   2. Submit two samples 6 x 6-inch in size illustrating metal finish color.

E. Design Data:
   1. Submit structural design calculations for metal roofing [and structural supports] signed and sealed by professional engineer.

F. Manufacturer's Installation Instructions: Submit instructions including special procedures for roofing penetrations, flashings, and perimeter conditions requiring special attention.

G. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.
1.5 QUALITY ASSURANCE
A. Calculate structural properties of framing members in accordance with AISI SG-973.

1.6 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
B. Installer: Company specializing in performing work of this section with minimum three years documented experience and approved by manufacturer.

1.7 PRE-INSTALLATION MEETINGS
A. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.
B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
C. Prevent contact with materials causing discoloration or staining.

1.9 FIELD MEASUREMENTS
A. Verify field measurements prior to fabrication.

1.10 COORDINATION
A. Coordinate with Work of Section 05400 - Cold-Formed Metal Framing for connecting structural supports to building structural frame.

1.11 WARRANTY
A. Furnish 20-year manufacturer warranty for sheet metal roofing against structural failure, corrosion, and water penetration.
B. Furnish 20-year manufacturer warranty for metal finish against fading, chipping, chalking, and blistering.
PART 2 PRODUCTS

2.1 MANUFACTURED SHEET METAL ROOFING

A. Manufacturers:
   1. Firestone Building Products
      310 East 96th Street Indianapolis, IN 46240
      800.428.4511
      a) Model UC-3, 1-1/2" flat lock panel
   2. Or Approved Equal.
   3. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

2.2 SHEET METAL MATERIALS

A. Panel: Zinc Alloy Rolled Flat Panel. Factory formed metal roofing panel system with concealed fasteners.

B. Thickness: 0.028"

C. Seams:
   1. Seam Height shall be 1.5"
   2. Seam spacing shall be 12"
   3. Shall be mechanically locked in the field
   4. Have integral seam sealant in leg of panel.

D. Finish shall be pre-weathered

E. Color: As selected from manufacturer's standard color palette

2.3 STRUCTURAL SUPPORTS

A. Roof Rafters: Metal framing as specified in Section 05400.

2.4 ACCESSORIES

A. Fasteners: Stainless Steel

B. Installation Clips: Stainless Steel

C. Underlayment:
   1. Synthetic Non Self-Adhering Membrane
   2. Manufacturer:
      a. Grace Building Products, “Grace Tri Flex”
      b. Approved Equal.

D. Slip Sheet: Rosin sized building paper.
E. Sealant:
   1. 100% solid, pressure sensitive tape sealant with release paper.

F. Reglets: Recessed type, Zinc Alloy Rolled

G. Splash Pads: Precast concrete type, minimum size 8”x12”; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.

2.5 SNOWGUARDS

A. Manufacturer
   1. Basis of design – Alpine Snow guards
      a. Model PD81
   2. Berger
   3. Or approved equal

2.6 FABRICATION

A. Form sections shape as indicated on Drawings, accurate in size, square, and free from distortion or defects.

B. Fabricate facia, trim, flashing, and other metal components from same material as metal roof panels. Provide exposed metal surfaces with same finish as exposed face of metal roof panels.

C. Fabricate cleats of same material as sheet, to interlock with sheet.

D. Fabricate starter strips of same material as sheet, continuous, to interlock with sheet.

E. Form pieces in longest practical lengths.

F. Hem exposed edges on underside 1/2 inch; miter and seam corners.

G. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

H. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

I. Fabricate gutters to profile and size conforming to specified design requirements.

J. Fabricate downspouts to profile and size conforming to specified design requirements.

K. Fabricate accessories in profile and size to suit gutters and downspouts.
   1. Anchorage Devices: In accordance with SMACNA.
   2. Gutter Supports: Brackets
   3. Downspout Supports: Straps
PART 3 EXECUTION

3.1 EXAMINATION

A. Wood and Metal Deck Substrate:
   1. Inspect roof deck to verify deck is clean and smooth, free of depressions, waves, or projections, and properly sloped eaves.
   2. Verify deck is dry verify substrate joints are solidly supported and fastened.
   3. Verify wood nailers are installed and correctly located.

B. Structural Framing Substrate:
   1. Verify primary and secondary framing members are installed and fastened, properly aligned and sloped to gutters and eaves.
   2. Verify damaged shop coatings are repaired with touch up paint.

C. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

A. Wood and Metal Deck Substrate:
   1. Fill knot holes and surface cracks with latex filler at areas of bonded eave protection.
   2. Broom clean deck surfaces under eave protection [and underlayment].

B. Back paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to minimum dry film thickness of 15 mil.

3.3 INSTALLATION - STRUCTURAL SUPPORTS

A. Install structural supports in accordance with drawings.

B. Align supports with top surface in plane, uniformly sloped to eaves.

C. Install supports spaced maximum @ 1’-6” feet on center. Provide support at roof panel end laps.

D. Secure supports to building structural frame with mechanical fasteners.

3.4 INSTALLATION - EAVE PROTECTION

A. Apply eave protection sheet over deck flange of eave edge flashings.

3.5 INSTALLATION - UNDERLAYMENT

A. Apply underlayment over entire roof area in single layer fastened to substrate.
   1. Install underlayment laid perpendicular to slope.
   2. Weather lap edges 2 inches and nail in place.
   3. Stagger end joints minimum 24 inches.
3.6 INSTALLATION - STANDING SEAM METAL ROOFING
A. Conform to SMACNA and NRCA details.

3.7 INSTALLATION - FLASHING
A. Place eave edge metal flashings tight to fascia. Weather lap joints 2 inches and seal. Secure flange to substrate.
B. Secure flashings in place using concealed fasteners.
C. Secure flashing exposed edges with continuous cleats.
D. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
E. Seal metal joints watertight.

3.8 INSTALLATION - GUTTERS AND DOWNSPOUTS
A. Built-In Gutters:
   1. Secure gutter lining to substrate with cleats spaced minimum 24 inches on center along edges of gutters.
   2. Longitudinal joints not acceptable.
   3. At roof edges, extend gutter lining under metal roofing 6 inches minimum and terminate in 3/4 inch folded edge secured by cleats. Hook lower end of roofing into lock strip to form 3/4 inch wide loose-lock seam.
B. Secure downspouts in place using fasteners.
C. Slope gutters minimum 1/16 inch per foot.
D. Seal gutters watertight. Seal joint of gutter to drain.
E. Connect downspouts to existing downspout boots. Grout connection watertight.

3.9 INSTALLATION - SNOW GUARDS
A. Install snow guards in accordance with manufacturer’s instructions.
B. Install snow guards in continuous line, 12 inches up slope of exterior wall.
C. Install one additional line of snow guards for every 15 feet measured along roof slope.

3.10 PROTECTION OF INSTALLED CONSTRUCTION
A. Do not permit traffic over unprotected roof surface.
PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item for DIVISION 7.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section includes flashings and counter flashings and fabricated sheet metal items.

B. Related Sections:
   1. Section 04810 - Unit Masonry Assemblies: Through-wall flashings in masonry.
   3. Section 07550 - Modified Bituminous Membrane
   4. Section 07613 - Manufactured Sheet Metal Roofing.
   5. Section 07714 - Gutters and Downspouts.

1.2 REFERENCES

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

B. Sheet Metal and Air Conditioning Contractors:

1.3 DESIGN REQUIREMENTS

A. Sheet Metal Flashings: Conform to the requirements of SMACNA Architectural Sheet Metal Manual.

1.4 SUBMITTALS

A. Submit under the requirements of the General Provisions for Construction.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
C. Product Data: Submit data on manufactured components metal types, finishes, and characteristics.

1.5 QUALIFICATIONS
A. Fabricator and Installer: Company specializing in sheet metal work with minimum five years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

C. Prevent contact with materials causing discoloration or staining.

1.7 COORDINATION
A. Coordinate with Work of Section 04810 for installing masonry flashing.

PART 2 PRODUCTS

2.1 SHEET METAL FLASHING AND TRIM
A. Flashing at sheet metal roofing:
   1. Material: Zinc Alloy Rolled Flat Panel
   2. Thickness: 7mm (24 Ga.)
   3. Finish: Pre-weathered

B. Flashing at modified bitumen roofing:
   1. Material: Galvanized Sheet Metal
   2. Thickness: 22 Gauge
   3. Finish: Fluoropolymer - Coil applied or Post finished Color as selected by Architect.

C. Through wall flashing at steel lintels:
   1. Material: Copper
   2. Thickness: 16oz

2.2 ACCESSORIES
A. Fasteners: Stainless steel with soft neoprene washers at

B. Underlayment: Refer to Specification Section 07613

C. Sealant: Polyurethane or silicone type as specified in Section 07900.
2.3 FABRICATION

A. Form sections shape indicated on Drawings, accurate in size, square, and free from distortion or defects.

B. Fabricate cleats of same material as sheet metal, interlocking with sheet.

C. Form pieces in longest possible lengths.

D. Hem exposed edges on underside 1/2 inch; miter and seam corners.

E. Form material with standing seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

F. Tin edges of copper sheet to be soldered. Solder shop formed metal joints. After soldering, remove flux. Wipe and wash solder joints clean. Weather seal joints.

G. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

H. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

I. Fabricate flashings to allow toe to extend 2 inches over roofing. Return and brake edges.

J. Fabricate snow guards in accordance with SMACNA Architectural Sheet Metal Manual.

K. Seal metal joints.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Paint concealed metal surfaces with protective backing paint to minimum dry film thickness of 15 mils.

3.3 INSTALLATION

A. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.
B. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

C. Apply plastic cement compound between metal flashings and felt flashings.

D. Seal metal joints watertight.

3.4 FIELD QUALITY CONTROL

A. Inspection will involve surveillance of Work during installation to ascertain compliance with specified requirements.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item for DIVISION 7.

END OF SECTION
SECTION 07714
GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes pre-finished zinc alloy steel gutters and downspouts.

B. Related Sections:
   1. Section 07613 - Manufactured Sheet Metal Roofing.
   2. Section 07620 - Sheet Metal Flashing and Trim.

1.2 REFERENCES

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

B. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - Architectural Sheet Metal Manual

1.3 DESIGN REQUIREMENTS


1.4 SUBMITTALS

A. Submit under the requirements of the General Provisions for Construction.

B. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.

C. Product Data: Submit data on manufactured components, materials, and finishes.

D. Samples: Submit two samples, 6 inches long, illustrating component design, finish, color, and configuration.

1.5 QUALITY ASSURANCE

1.6 DELIVERY, STORAGE, AND HANDLING
   A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.
   B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope to drain.
   C. Prevent contact with materials during storage capable of causing discoloration, staining, or damage.

1.7 WARRANTY
   A. Furnish 20 year manufacturer warranty for gutter and downspout finishes.

PART 2 PRODUCTS

2.1 GUTTERS AND DOWNSPOUTS
   A. Description:
      1. Gutters and Downspouts: SMACNA Rectangular style profile, as indicated on Drawings.

2.2 COMPONENTS
   A. 24 ga. Zinc Alloy Rolled Flat Panel, pre-weathered finish

2.3 ACCESSORIES
   A. Anchors and Supports: Profiled to suit gutters and downspouts.
      2. Gutter Supports: Brackets.
      3. Downspout Supports: Brackets.
   B. Fasteners: stainless steel, with soft neoprene washers.

2.4 FABRICATION
   A. Form gutters and downspouts of profiles and size indicated on drawings.
   B. Fabricate with required connection pieces.
   C. Form sections to shape indicated on Drawings, square, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.
   D. Hem exposed edges of metal.
PART 3 EXECUTION

3.1 EXAMINATION

A. Verify surfaces are ready to receive gutters and downspouts.

3.2 PREPARATION

A. Paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to minimum dry film thickness of 15 mil.

3.3 INSTALLATION

A. Sheet Metal: Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts and accessories.

B. Slope gutters 1/16 inch per foot minimum.

C. Solder metal joints for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.

D. Connect downspouts to downspout shoes at 6 inches above grade. Seal connection watertight.

E. Set splash pads under downspouts. Secure in place.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item for DIVISION 7.

END OF SECTION
SECTION 07840
FIRESTOPPING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes firestopping and through-penetration protection system materials and accessories between elevator machine room and elevator shaft.

B. Related Sections:
   1. Section 15060 - Hangers and Supports: Mechanical work requiring firestopping.
   2. Section 16070 - Electrical Hangers and Supports: Electrical work requiring firestopping.

1.2 REFERENCES

A. ASTM International:

B. Underwriters Laboratories Inc.:
   1. UL 1479 - Fire Tests of Through-Penetration Firestops.
   2. UL - Fire Resistance Directory.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A. Firestopping Materials: ASTM E814 or UL 1479 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1-hour fire rating.

B. Surface Burning: ASTM E84 with maximum flame spread / smoke developed rating of 25/450.

C. Firestop interruptions to fire rated assemblies, materials, and components.
1.5 PERFORMANCE REQUIREMENTS
   A. Conform to NJUCC Building Subcode (2015 IBC-NJ) for fire resistance ratings and surface burning characteristics.

1.6 SUBMITTALS
   A. Submit under the requirements of the General Provisions for Construction.
   B. Product Data: Submit data on product characteristics, performance and limitation criteria.
   C. Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.
   D. Manufacturer's Installation Instructions: Submit preparation and installation instructions.

1.7 QUALIFICATIONS
   A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
   B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 FIRESTOPPING
   A. Manufacturers:
      1. 3M Corp., “Fire Barrier” CP 25WB or 2000N/S.
      3. Hilti Corp., “FS-One”.
      7. AD Fire Protection Systems, “FireBarrier”.
      8. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

   B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
      1. Silicone Firestopping Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

C. Color: As selected from manufacturer’s full range of colors to match adjacent finish.

2.2 FIRESTOPPING ACCESSORIES

A. General: Furnish NRTL listed products. Select products with rating not less than rating of wall or floor being penetrated.

B. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

C. Dam Material: As recommended by firestopping product manufacturer. Use mineral fiber where manufacturer’s instructions are silent.

D. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

E. Non-Rated Surfaces:
   1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
   2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.
B. Remove incompatible materials affecting bond.

3.3 APPLICATION

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.

3.4 FIELD QUALITY CONTROL

A. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.5 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Protect adjacent surfaces from damage by material installation.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item for DIVISION 7.
SECTION 07900

JOINT SEALERS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes sealants, joint backing, and accessories.

B. Related Sections:
   1. Section 07613 – Manufactured sheet metal roofing
   2. Section 07840 - Firestopping: Firestopping sealants.
   3. Section 08800 - Glazing: Glazing sealants and accessories.
   4. Section 15160 - Hangers and Supports: Firestopping sealants for use with mechanical systems.
   5. Section 16170 - Electrical Hangers and Supports: Firestopping sealants for use with electrical systems.

1.2 REFERENCES

A. ASTM International:
   2. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.

1.3 SUBMITTALS

A. Submit under the requirements of the General Provisions for Construction.

B. Products Data: Submit data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

C. Manufacturer's Installation Instructions: Submit special procedures, surface preparation, and perimeter conditions requiring special attention.

D. Warranty: Include coverage for installed sealants and accessories failing to achieve airtight or watertight seal (as applicable); exhibit loss of adhesion or cohesion; and, sealants which do not cure.
1.4 QUALITY ASSURANCE
A. Maintain one copy of each referenced document covering installation requirements on site.

1.5 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 ENVIRONMENTAL REQUIREMENTS
A. Maintain temperature and humidity recommended by sealant manufacturer during and after installation.

1.7 COORDINATION
A. Coordinate Work with sections referencing this section.

PART 2 PRODUCTS

2.1 JOINT SEALERS
A. High Performance General Purpose Exterior Sealant:
   1. Manufacturer:
      a. Sika Corp., “SikaFlex 1A”, or approved equal.
      b. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
   2. Description: ASTM C920; Polyurethane, Grade NS, Class 25, Uses T, NT, O, M, G, and I; single component.
      b. Applications: Use for control, expansion, and soft joints in masonry; joints between concrete and other materials; joints between metal frames and other materials; and other exterior joints for which no other sealant is indicated.
      c. Applications: Use for adhering insulated concrete forms, architectural foam and drywall, and sealing cracks and voids.
B. Exterior Metal Lap Joint Sealant:
   1. Manufacturer:
      b. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
   2. Description: 2 Part Sealant tape (Butyl and Polyisobutylene), non-drying, non-skinning, non-curing.
a. Color: Black.
b. Applications: Use for concealed sealant bead in sheet metal work and concealed sealant bead in siding overlaps.

2.2 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 D1056, sponge or expanded rubber or D1667, 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

3.1 EXAMINATION

A. Verify substrate surfaces and joint openings are ready to receive work.

B. Verify joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

A. Remove loose materials and foreign matter impairing adhesion of sealant.

B. Clean and prime joints.

C. Perform preparation in accordance with ASTM C1193.

D. Protect elements surrounding Work of this section from damage or disfiguration.

3.3 INSTALLATION

A. Perform installation in accordance with ASTM C1193.

B. Perform acoustical sealant application work in accordance with ASTM C919.

C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.

D. Install bond breaker where joint backing is not used.
E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

G. Tool joints concave unless otherwise indicated.

H. Do not stretch precompressed foam sealant; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch below adjoining surface.

3.4 CLEANING

A. Clean adjacent soiled surfaces.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Protect sealants until cured.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item for DIVISION 7.

END OF SECTION
SECTION 08114
STANDARD STEEL DOORS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes fire rated, and thermally insulated steel doors.

B. Related Sections:
   1. Section 08115 - Standard Steel Frames.
   2. Section 08710 - Door Hardware.
   3. Section 09900 - Paints and Coatings: Field painting of doors.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.

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

C. National Fire Protection Association:

D. Underwriters Laboratories Inc.:
   1. UL 10B - Fire Tests of Door Assemblies.

1.3 SUBMITTALS

A. Submit under the requirements of the General Provisions for Construction.

B. Shop Drawings: Indicate door elevations, internal reinforcement, closure method, and cut-outs for glazing, louvers, and finishes.

C. Product Data: Submit door configurations, location of cut-outs for hardware reinforcement.

D. Manufacturer's Installation Instructions: Submit special installation instructions.

E. Manufacturer’s Certificate: Certify Products meet or exceed specified requirements.
1.4 QUALITY ASSURANCE
B. Fire Rated Door Construction: Conform to NFPA 252 or UL 10B.
C. Installed Door Assembly: Conform to NFPA 80 for fire rated class as indicated on Drawings.

1.5 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years documented experience.
B. Installer: Company specializing in performing work of this section with minimum five years documented experience and approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.
B. Accept doors on site in manufacturer's packaging. Inspect for damage.
C. Break seal on site to permit ventilation.

1.7 COORDINATION
A. Coordinate Work with door opening construction, door frame, and door hardware installation.
B. Coordinate installation to accommodate door hardware electric wire connections.

PART 2 PRODUCTS
2.1 STANDARD STEEL DOORS
A. Exterior Doors (Exterior/Rated):
   1. Manufacturer:
      a. Pioneer Industries, Inc., Type CHT14, or approved equal.
      b. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction
   2. Description: ANSI A250.8, 1-3/4 inch thick; Level 3 - Extra Heavy Duty, Model 2; 14-gauge galvannealed steel sheet, seamless design, flush welded ends; polyurethane insulated core.
2.2 FABRICATION
   A. Fabricate doors with hardware reinforcement welded in place.
   B. Primer: ANSI A250.10 rust inhibitive type.
   C. Attach fire rating label to each fire rated door.
   D. Configure exterior doors with edge profile to receive recessed weatherstripping.

2.3 SHOP FINISHING
   A. Exterior Doors: Galvanized to ASTM A653/A653M A60.

PART 3 EXECUTION

3.1 EXAMINATION
   A. Verify opening sizes and tolerances are acceptable.

3.2 INSTALLATION
   A. Install doors in accordance with ANSI A250.8.
   B. Install door louvers, plumb and level.
   C. Coordinate installation of glass and glazing specified in Section 08800.
   D. Coordinate installation of doors with installation of frames specified in Section 08115 and hardware specified in Section 08710.
   E. Touch-up damaged shop finishes.

3.3 ERECTION TOLERANCES
   A. Maximum Diagonal Distortion: 1/8-inch measured with straight edge, corner to corner.

3.4 ADJUSTING
   A. Adjust door for smooth and balanced door movement.

3.5 SCHEDULE
   A. Refer to Door and Frame Schedule appended to this section.
PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item for DIVISION 8.

END OF SECTION
SECTION 08115
STANDARD STEEL FRAMES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes fire rated, non-rated and thermally insulated steel frames.

B. Related Sections:
   1. Section 03300 - Cast-In-Place Concrete: Masonry grout fill of metal frames and placement of anchors into masonry wall construction.
   2. Section 04810 - Unit Masonry Assemblies: Masonry grout fill of metal frames and placement of anchors into masonry wall construction.
   3. Section 08114 - Standard Steel Doors.
   4. Section 08710 - Door Hardware: Hardware, silencers, and weather-stripping.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.

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

C. National Fire Protection Association:

D. Underwriters Laboratories Inc.:
   1. UL 10B - Fire Tests of Door Assemblies.

1.3 SUBMITTALS

A. Submit under the requirements of the General Provisions for Construction.

B. Shop Drawings: Indicate frame elevations, reinforcement, anchor types and spacing, location of cut-outs for hardware, and finish.

C. Product Data: Submit frame configuration and finishes.

D. Manufacturer's Installation Instructions: Submit special installation instructions.
E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Conform to requirements of ANSI A250.8.

B. Fire Rated Frame Construction: Conform to NFPA 252 or UL 10B.

C. Installed Frame Assembly: Conform to NFPA 80 for fire rated class same as fire door.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.

B. Accept frames on site in manufacturer's packaging. Inspect for damage.

C. Break seal on-site to permit ventilation.

1.7 COORDINATION

A. Coordinate Work with frame opening construction, door, and hardware installation.

B. Sequence installation to accommodate required door hardware electric wire connections.

PART 2 PRODUCTS

2.1 STANDARD STEEL FRAMES

A. Manufacturers:
   1. Pioneer Industries, Inc., Series F-14 or approved equal.
   2. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Product Description: Standard shop fabricated steel frames, fire rated and non-rated types.
   1. Frames: To suit ANSI A250.8 Grade and Model of door specified in Section 08114.
2.2 ACCESSORIES

A. Removable Stops: Rolled steel channel shape, mitered corners; prepared for countersink style tamper proof screws.

B. Bituminous Coating: Non-asbestos fibered asphalt emulsion.

C. Primer: ANSI A250.10 rust inhibitive type.

D. Silencers: Resilient rubber or vinyl, fitted into drilled hole.

E. Weatherstripping: Specified in Section 08710.

2.3 FABRICATION

A. Fabricate frames for knock down field assembly.

B. Fabricate frames with hardware reinforcement plates welded in place. Provide mortar guard boxes.

C. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.

D. Terminate door stops 6 inches above finished floor. Cut stop at 90 degree angle and close.

E. Prepare frames for silencers. Provide three single silencers for single doors.

F. Configure exterior frames with special profile to receive recessed weatherstripping.

G. Attach fire rated label to each fire rated frame.

H. Fabricate frames to suit masonry wall coursing.

2.4 SHOP FINISHING

A. Exterior Doors: Galvanized to ASTM A653/A653M A60.

B. Interior Doors: Primed.

C. Coat inside of frame profile with bituminous coating to minimum thickness of 1/16-inch.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify opening sizes and tolerances are acceptable.
3.2 INSTALLATION
   A. Install frames in accordance with ANSI A250.8.
   B. Coordinate with masonry and gypsum board wall construction for anchor placement.
   C. Coordinate installation of glass and glazing specified in Section 08800.
   D. Coordinate installation of frames with installation of hardware specified in Section 08710 and doors in Section 08114.
   E. Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

3.3 ERECTION TOLERANCES
   A. Maximum Diagonal Distortion: 1/8-inch measured with straight edges, crossed corner to corner.

3.4 SCHEDULE
   A. Refer to Door and Frame Schedule appended to this section.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT
   A. Measurement: The work of this section shall not be measured.
   B. Payment: The cost of this section shall be included in the lump sum bid item for DIVISION 8.

END OF SECTION
SECTION 08511
ROLLED STEEL WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide steel operable and fixed windows, glazing and required accessories, and as shown on the Drawings and as specified.

B. Related Sections:
   1. Section 07900 - Joint Sealers: Perimeter sealant and back-up materials.
   2. Section 08800 - Glazing.

1.2 REFERENCES

   3. ASTM E331- Test for Water Penetration.
   5. ASTM E-783-93 - Method of Field Measurement of Air and Water Leakage through Installed Exterior Windows and Doors.

B. American National Standards Institute (ANSI).

C. Safety Glazing Certification Council (SGCC).

1.3 SUBMITTALS

A. The Contractor shall submit the following information in accordance with the General Provisions:
   1. Product Data.
a. Submit manufacturer’s specifications, recommendations and standard details for steel window units, including certified test laboratory reports as necessary to show compliance with requirements.

2. Shop Drawings.
   
a. Submit shop drawings, including location floor plans or exterior wall elevations showing typical unit elevations at 3/4” scale, and full size detail sections of every typical composite member. Show anchors, sill, surround and other components not included in manufacturer's standard data. Include glazing details and standards for factory glazed units. Include test reports for testing specified in Art. 1.05.

b. Indicate daylight glass opening dimensions on Shop Drawings for windows.

c. Tolerance:
   
   1) The daylight glass openings as actually fabricated in the sash, shall not vary more than 1/16” plus or minus from the daylight opening dimensions indicated on the Shop Drawings.

   d. Responsibility:
   
   1) If the daylight openings as actually fabricated in the sash vary from these dimensions and tolerance noted and, if the glazing for these openings has been manufactured, but cannot be installed due to these dimensional differences, then the sash manufacturer must procure new glazing for these openings without additional cost to NJ Transit.

3. Samples.
   
a. Submit full size corner of window frame and window surround for approval before fabrication.

b. If full size unit is submitted, approved window sample may be used on job for actual installation.

4. Finish.
   
a. Color shall be as selected by Architect. Submit sample for NJ Transit Engineer's approval before proceeding with production.

b. Use these samples for comparison purposes during production finishing; provide actual production sections large enough so that good comparisons can be made to establish allowable color
range.

5. Submit platform windscreen shop drawings, calculations, and certifications signed and sealed by a licensed NJ professional. If the manufacturer is unable to provide signed and sealed the calculations and drawings by a NJ Licensed Professional, then signed and sealed Drawings by a Licensed Engineer in the State of Manufacture is acceptable.

1.4 QUALITY ASSURANCE

A. Performance and Testing.
Except as otherwise indicated, comply with applicable load tests specified in ANSI/ASTM for type and classification of window units required in each case.

1. Testing:

a. Where manufacturer's standard window units comply with requirements and have been tested in accordance with specified tests, provide certification by manufacturer showing compliance with such tests; otherwise, perform required tests through a recognized testing laboratory or agency, approved in advance by NJ Transit and provide certified test results.

b. Test reports shall be not more than four years old.

c. Specific Performance Requirements:

1) Windows shall conform to specified ANSI/ASTM Uniform Load Structural Test standards.

2) A minimum exterior and interior uniform load of 30 pounds per square foot shall be applied to the entire outside surface of the test unit. This test load shall be maintained for a period of 10 seconds. At the conclusion of tests, there shall be no glass breakage, permanent damage of fasteners, hardware parts, support arms, actuating mechanisms, or any other damage causing the window to be inoperable. There shall be no permanent deformation of any frame or sash member in excess of 0.4 percent of its span.

d. Wind Loads:

1) Basic Wind Speed: 100mph
2) Wind Exposure: C
3) Wind Importance factor: 1

e. Deflection of Framing Members:
1) Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed L/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 1/2 inch, whichever is less.

B. Manufacturer's Experience.

1. Window manufacturer shall have a minimum of five years successful experience in the regular manufacture of types and sizes of windows specified herein.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Store and handle windows, mullions, panels, hardware and appurtenant items in strict compliance with the manufacturer's instructions.

B. Protect units adequately against damage from the elements, construction activities and other hazards before, during and after installation.

1.6 SPECIAL PROJECT WARRANTIES:

A. Manufacturer's Warranties.

1. Submit written warranties from window manufacturer for the following:

a. Windows:

   1) Windows furnished are certified as fully warranted against any defects in material or workmanship under normal use and service for a period of ten (10) years from date of acceptable installation.

b. Finish:

   1) The finishes on windows and component parts (such as panning, trim, mullions) are certified as complying fully with requirements of AAMA Section 603.6 and fully warranted against chipping, peeling, cracking or blistering for a period of ten (10) years from date of installation.

c. Glazing:

   1) Laminated Glass - five (5) years.

PART 2 - PRODUCTS
2.1 ROLLED STEEL WINDOWS

A. Manufacturers

2.2 COMPONENTS

A. Windows shall be manufactured from special solid hot-rolled steel sections.
   1. Sections shall be made from new billet steel with weathering flanges and glazing leg rolled integral at the mill.
   2. Window frame sections shall be unequal leg or equal leg channel shapes, as required, not less than 1-3/8” deep front to back and not less than 1/8” thick.
   3. Combined one-piece frame perimeter sections shall be not less than 1-5/16” total depth.
   4. Unequal leg frame sections shall provide a wall bearing of not less than 1/2” and with ventilator frame section shall have a nominal weight of 4.15 lbs. per lineal foot.
   5. Equal leg frame sections with ventilator frame section shall have a nominal weight of 3.5 lbs. per lineal foot.
   6. Muntins shall be Tee-shaped sections not less than 1-5/16” deep front to back and not less than 1/8” thick.

B. Glazing beads shall be extruded aluminum alloy 6063-T5 with a minimum thickness of 0.055”.

C. Sealant.
   1. Provide elastomeric type as recommended by window manufacturer for joint size and movement, to remain permanently elastic, non-shrinking and non-migrating.
   2. Manufacturer shall be equal to:
      a. Sika Chemical Corporation - Sika Flex #1a/15LM.
      b. Tremco - Dymonic (one part).
      c. Pecora Corporation - Dynatrol I.
      d. Sonneborn - Sonolastic NP-1.
   3. Materials:
a. One component polyurethane gun grade fast skinning fast curing polyurethane sealant meeting ASTM C-920 Class 12-1/2 for 25% total movement ± 12-1/2% joint movement moisture cured as per ASTM C-920, self priming on most materials (FS TT-S-00230C) in color to match adjacent mortar standard color as selected.

2.3 FIXED STEEL WINDOWS OR PANEL FRAMES

A. No operating hardware or equipment is required.

2.5 GLAZING

A. Refer to Section 08800 Glazing

2.6 GLAZING ACCESSORIES

A. For exterior glazing, except for use in deep channels.

1. Dow Corning 999-A; GE Silglaze N2500; Rhone-Poulenc’s Rhodorsil 3B; or approved equal.

2. Type 1 Glazing Material: Silicone Rubber Glazing Sealant; silicone rubber one-part elastomeric sealant; FS TT-S-001543, Class A; acid-type for non-porous channel surfaces, and non-acid type where any of the channel surfaces are porous.

B. For exterior glazing.

1. Use in deep channel glazing; paintable.

2. Products: W.R. Meadows Dualthane and CM-60 two-part; Pecora’s GC-5 Synthacalk; Sonneborn’s Sonolastic two-part; or approved equal.

3. Type 2 Glazing Material: Polysulfide glazing sealant; polysulfide two-part elastomeric sealant; FS TT-S-00227, Type II, Class A, compounded by manufacturer specifically for glazing.

C. For channel glazing and for small lights.

1. Products: W.R. Meadows Solaply; Pecora’s 60+ Unicrylic Acrylic; Tremco’s Mono; or approved equal.

D. Setting Blocks.

1. Neoprene, 70-90 durometer hardness, with proven compatibility with sealants used.

E. Spacers.
1. Neoprene, 40-50 durometer hardness, with proven compatibility with glazing materials used.

F. Compressible Filler Rod.

1. Closed-cell or waterproof-jacketed rod stock of synthetic rubber or plastic foam, proven to be compatible with glazing materials used, flexible and resilient, with 5-10 psi compression strength for 25% deflection.

G. Cleaner, Primers, and Sealers.

1. Type recommended by glazing material manufacturer.

2.7 FABRICATION AND ACCESSORIES

A. General.

1. Provide manufacturer’s standard fabrication and accessories, which comply with specifications indicated. Provide complete system for assembly of components and anchorage of window units and prepare complete preglazing at factory.

B. Window Members.

1. All window members, including muntin bars, shall be free of scale.

C. Fabricate windows in accordance with approved shop drawings.

D. Prior to fabrication all hot-rolled steel sections shall be cleaned to remove mill scale and rust.

E. Corners of frames shall be mitered and/or coped, then machine welded, and all contact and exposed surface welds dressed smooth. Muntin to frame intersections shall be coped, tenoned, and riveted.

F. Glazing.

1. Units shall be glazed in the field.

2. Lights shall be designed for inside glazing against 15/16" high rabbets.

3. Provide continuous snap-in glazing beads to suit the glass thickness as specified.

G. Factory Finishing.

1. Material shall be either chemically or mechanically cleaned to remove mill scale, dirt, oil and other foreign matter.
2. After fabrication, windows, covers and trim shall be zinc phosphated in a multiple stage process as a preparation for receiving paint.

3. After pretreatment, a coat of epoxy primer shall be applied and oven baked, at 375°F, resulting in a dry film thickness of not less than one mil.

4. Finish:
   a. After prime coat, a coat of Aliphatic Urethane shall be shop applied and oven baked, at 375°F, resulting in a dry film thickness of not less than one mil.

5. Color of finish coat shall be as selected by Architect. Submit sample for confirmation by NJ Transit Engineer's approval before proceeding with production.

PART 3 - EXECUTION

3.1 EXAMINATION

A. After delivery of the windows to the site of the work and before installation, NJ Transit reserves the right to select at random one window of each type required for the Project and remove them to the office of NJ Transit for examination and inspection.

B. If, after examination and inspection it is found that the window does not comply with the requirements of the Specifications, all windows of this same type shall be inspected and corrected, if required, and if not able to be corrected at the Site, shall be removed from the Site of the Work by, and at the expense of, the Contractor.

C. If, after examination and inspection it is found that the windows comply with the requirements of the Specifications, the Contractor shall proceed with the installation of all windows including those examined and inspected by the Engineer. Any windows damaged during the course of examination and inspection, which has been found acceptable, will be replaced by the Manufacturer at the expense of NJ Transit.

D. Window shall conform to details and dimensions shown on the approved shop drawings.

E. Conditions, which may adversely affect the window installation, must be corrected by the General Contractor before installation at no additional cost to NJ Transit.

3.2 INSTALLATION

A. Comply with manufacturer's specifications and recommendations for installation of window units, hardware operators and other components of work.

B. Install windows in openings in strict accordance with approved shop drawings.
1. Set units plumb, level and true to line, without warp or rack of frames or ventilators.

2. Anchor units securely to surrounding construction with approved fasteners.

3. Exterior metal-to-metal joints between windows, trim and mullions shall be properly sealed watertight with approved sealant and neatly pointed.

C. All fasteners required to attach windows to adjacent construction shall be furnished by window erector.

D. Abraded areas of the window, cover, trim or mullion finish shall be cleaned and touched up with air dry paint, furnished by the window manufacturer, in a color to match factory applied finish.

F. Provide protection for the window finish to prevent damage during the course of building operations and remove finish protection before final inspection of the windows.

3.3 ADJUST AND CLEAN

A. Clean steel surfaces promptly after installation of windows, exercising care to avoid damage to protection coatings and finishes. Remove excess glazing and sealant compounds, dirt, and other substances. Lubricate hardware and moving parts, as required for proper operation.

B. Clean glazing, in manner recommended by the glazing material Manufacturer, promptly after installation of windows. Remove glazing sealant compound, dirt and other substances.

C. Provide finish or glass protection necessary due to cleaning of adjacent materials.

D. Initiate protection and other precautions required to ensure that window units are without damage or deterioration (other than normal weathering) at time of acceptance.

E. Send to NJ Transit written recommendations for maintenance and protection of windows, after final acceptance.

PART 4 – MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item for Division 8.
SECTION 08550
WOOD WINDOWS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes factory fabricated metal clad wood windows with fixed sash, factory glazed and operating hardware.

B. Related Sections:
2. Section 07900 - Joint Sealers: Perimeter sealant and back-up materials.
3. Section 09900 - Paints and Coatings: Site finishing wood surfaces.

1.2 REFERENCES

A. American Architectural Manufacturers Association:
1. AAMA 101 - Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors.

B. American Society of Civil Engineers:

C. ASTM International:
1. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences across the Specimen.

D. Glass Association of North America:

E. National Fenestration Rating Council Incorporated:
1. NFRC 100 - Procedures for Determining Fenestration Product U-Factors.
2. NFRC 400 - Procedure for Determining Fenestration Product Air Leakage.
1.3 SYSTEM DESCRIPTION

A. Wood Windows: Wood metal clad sections, factory fabricated, vision glass, related flashings, anchorage and attachment devices.

B. Configuration: Fixed, non-operable sash.

1.4 PERFORMANCE REQUIREMENTS

A. System Design: Design and size components to withstand dead loads and live loads caused by positive and negative wind loads acting normal to plane of wall, including increased loads at building corners as required by NJUCC Building Subcode 2015 ICC International Building Code, as amended; and ASCE 7.

B. Deflection: Limit member deflection to 1/175 of longer dimension with full recovery of glazing materials.

C. Lintel Deflection: Accommodate deflection of lintel without damage to components, deterioration of seals, or movement between window and perimeter framing.

D. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with pane of glass and heel bead of glazing compound.

E. System Internal Drainage: Drain water entering joints, condensation occurring in glazing channel, and moisture occurring within system to exterior by weep drainage network.

F. Thermal Movement: Design sections to permit thermal expansion and contraction of components to match perimeter opening construction.

G. Thermal Transmittance of Assembly: Maximum U Value of 0.57 Btu/sq ft per hour per deg F for fixed windows, and 0.67 Btu/sq ft per hour per deg F for operable windows in accordance with ASHRAE/IESNA 90.1-2004 for climate zone 4.

H. Air Infiltration: Limit air leakage through assembly to 0.4 cfm/sq ft of wall area in accordance with ASHRAE/IESNA 90.1-2004, measured at reference differential pressure across assembly of 1.57 psf as measured in accordance with NFRC 400 and ASTM E283.

I. Water Leakage: None, when measured in accordance with ASTM E547 with test pressure difference of 20 percent of design pressure, with minimum differential of 2.86 lbf/sq ft and maximum of 12.00 lbf/sq ft.

J. Forced Entry Resistance: ASTM F588 Grade 30 for assembly types indicated.
1.5 SUBMITTALS

A. Submit under the requirements of the General Provisions for Construction.

B. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work; and installation requirements.

C. Product Data: Submit component dimensions, anchorage and fasteners, glass, internal drainage details and for window hardware and accessories.

D. Submit two samples 12 x 12 inches in size illustrating window frame section; mullion section; factory finished surfaces and glazing materials.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements and performance criteria tests.

F. Manufacturer's Installation Instructions: Submit special procedures and perimeter conditions requiring special attention.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with the following:
   2. Glass: Fabricate glass units in accordance with GANA.

B. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing commercial wood windows with minimum three years documented experience.

B. Installer: Company specializing in performing commercial installation of wood windows with minimum three years documented experience and approved by manufacturer.

1.8 PRE-INSTALLATION MEETINGS

A. Convene minimum one week before starting Work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.

B. Protect factory finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.
1.10 ENVIRONMENTAL REQUIREMENTS

A. Do not install sealants when ambient temperature is less than 40 degrees F.

B. Maintain this minimum temperature during and after installation of sealants.

1.11 WARRANTY

A. Furnish five year manufacturer warranty for glass units from seal failure, interpane dusting or misting, and replacement of same.

B. Warranty:
   1. Include 20yr warranty coverage for degradation of color finish.
   2. Include 20yr warranty coverage for delamination or separation of finish cladding from window member.

PART 2 PRODUCTS

2.1 WOOD WINDOWS

A. Manufacturers:
   2. JELD-WEN Doors and Windows, Model “Premium Double Hung”.
   4. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Product Description: Production quality wood windows, factory finished, metal clad finished, fixed sash, glass and glazing.

2.2 COMPONENTS

A. Wood: Clear Pine species, clear preservative treated, of type suitable for opaque finish.

B. Aluminum Cladding Exterior Surface: Formed aluminum factory fit to profile or exterior exposed surface; factory finished.

C. Unit Frame Construction: Wood with fingered joint construction.

D. Fixed and Sliding Frame Construction: Wood with glued and steel pinned joint construction.

E. laminated Glass: conform with requirements in Section 08800:
   1. Minimum Total Unit Thickness: 1/2 inch.
   2. Glazing: Manufacturer’s standard conforming with requirements specified in Section 08800 - Glazing.
F. Glass Stops: Aluminum to match windows, sloped for wash.

G. Sills: Extruded aluminum sloped for positive wash; fit under sash to project 1/2 inch beyond wall face; one piece full width of opening.

2.3 ACCESSORIES

A. Anchors: Stainless steel.

B. Visual Glass Muntins: Solid wood applied at interior glass surface, extruded aluminum at applied to exterior glass surface.

2.4 FABRICATION

A. Fabricate framing and sash members with fingered joints; glue and steel pin joints.

B. Ensure joints and connections are flush, hairline, and weather-tight.

C. Finger joints permitted when wood matches in color and grain texture.

D. Form sills and stools in one piece. Slope sills for wash.

E. Furnish weather stop flange for perimeter of unit.

F. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet allowing installation and dynamic movement of perimeter seal.

G. Arrange fasteners to be concealed from view.

H. Permit internal drainage weep holes and channels to migrate moisture to exterior. Provide internal drainage of glazing spaces to exterior through weep holes.

I. Factory install glass in window units in accordance with manufacturer’s standard method conforming with GANA and to achieve performance criteria specified.

2.5 SHOP FINISHING

A. Exterior Surfaces: Factory applied finish on Aluminum cladding, color as selected by Architect.

B. Interior Surfaces: Primed for field opaque painting.
PART 3 EXECUTION

3.1 EXAMINATION

A. Verify wall openings and adjoining air and vapor seal materials are ready to receive work of this section, and opening dimensions and clearances are as indicated on shop drawings.

3.2 INSTALLATION

A. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

B. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.

C. Install sills.

D. 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.

E. Coordinate attachment and seal of perimeter air and vapor barrier materials.

F. Install operating hardware.

3.3 ERECTION TOLERANCES

A. Maximum Variation from Level and from Plumb: 1/16-inch every 3 feet non-cumulative or 1/8-inch per 10 feet, whichever is less.

3.4 ADJUSTING

A. Adjust for secure weathertight closure.

3.5 CLEANING

A. Remove protective material from factory finished surfaces.

B. Remove labels and visible markings.

C. Wash surfaces by method recommended and acceptable to sealant and window manufacturer; rinse and wipe surfaces clean.
PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item for DIVISION 8.

END OF SECTION
SECTION 08710
DOOR HARDWARE

PART 1 GENERAL

1.1 SUMMARY

A. Section includes hardware for steel doors. Provide door gaskets, including weatherstripping and seals, and thresholds as indicated in door schedule on Drawings.

B. Related Sections:
1. Section 08114 - Standard Steel Doors.
2. Section 08115 - Standard Steel Frames.

1.2 REFERENCES

A. American National Standards Institute:
2. ANSI/BHMA A156.1 - Butts and Hinges.
3. ANSI/BHMA A156.3 - Exit Devices.
4. ANSI/BHMA A156.4 - Door Controls - Closures.
5. ANSI/BHMA A156.5 - Auxiliary Locks and Associated Products.
6. ANSI/BHMA A156.6 - Architectural Door Trim.
7. ANSI/BHMA A156.10 - Power Operated Pedestrian Doors.
8. ANSI/BHMA A156.13 - Mortise Locks and Latches.
10. ANSI/BHMA A156.16 - Auxiliary Hardware.
11. ANSI/BHMA A156.18 - Materials and Finishes

B. Builders Hardware Manufacturers Association:
1. BHMA Directory of Certified Products.

C. National Fire Protection Association:

D. Underwriters Laboratories Inc.:
1. UL 10B - Fire Tests of Door Assemblies.
2. UL 305 - Panic Hardware.

1.3 PERFORMANCE REQUIREMENTS

A. Fire Rated Openings: Provide door hardware listed by Underwriter’s Laboratories, ETL/Intertek, Factory Mutual, Warnock-Hersey, or other testing firm acceptable to the authority having jurisdiction.
1. Hardware: Tested in accordance with NFPA 252.

1.4 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Shop Drawings:
   1. Indicate locations and mounting heights of each type of hardware, schedules, and catalog cuts.
   2. Submit manufacturer’s parts lists, and templates.

C. Samples:
   1. Submit one sample of typical hinge, latchset, lockset, and closer, illustrating style, color, and finish.
   2. Approved samples may be incorporated into Work.

D. Manufacturer’s Installation Instructions: Submit special procedures, and perimeter conditions requiring special attention.

1.5 CLOSEOUT SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Project Record Documents: Record actual locations of installed cylinders and their master key code.

C. Operation and Maintenance Data: Submit data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

D. Keys: Deliver with identifying tags to Owner by security shipment direct from hardware supplier.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with the following requirements:
   1. ANSI/BHMA A156 series standards.
   2. NFPA 80.
   3. UL 305.

B. Furnish hardware marked and listed in BHMA Directory of Certified Products.

C. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.
B. Hardware Supplier: Company specializing in supplying commercial/institutional door hardware with minimum five years documented experience, and approved by primary hardware manufacturer(s).

C. Hardware Supplier Personnel: Employ qualified hardware consultant to assist in work of this section.

1.8 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

B. Include persons involved with installation of doors, frames, and hardware.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.

B. Package hardware items individually with necessary fasteners, instructions, and installation templates, when necessary; label and identify each package with door opening code to match hardware schedule.

1.10 COORDINATION

A. Coordinate Work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware and recessed items.
   1. Provide templates or actual hardware as required to ensure proper preparation of doors and frames.

B. Sequence installation to accommodate required utility connections.

C. Coordinate Owner's keying requirements during course of Work.

1.11 WARRANTY

A. Furnish product warranties and product bonds in accordance with General Provisions for Construction.

B. Furnish two-year manufacturer warranty for locksets and door closers.

1.12 MAINTENANCE MATERIALS

A. Furnish special wrenches and tools applicable for each different and for each special hardware component.

B. Furnish maintenance tools and accessories supplied by hardware component manufacturer.
1.13 EXTRA MATERIALS

A. Furnish spare parts and maintenance products in accordance with General
Provisions for Construction.

B. Furnish ten extra key lock cylinders for each master keyed group.

PART 2 PRODUCTS

2.1 DOOR HARDWARE

A. General Requirements: Where not specifically indicated, comply with applicable
ANSI/BHMA A156 standard for type of hardware required. Furnish each type of
hardware with accessories as required for applications indicated and for
complete, finished, operational doors.
1. Templates: Furnish templates or physical hardware items to door and
frame manufacturers sufficiently in advance to avoid delay in Work.
2. Reinforcing Units: Furnished by door and frame manufacturers;
coordinated by hardware supplier or hardware manufacturer.
3. Fasteners: Furnish as recommended by hardware manufacturer and as
required to secure hardware. Match finish of hardware item being
fastened
4. Fire Ratings: Listed for type of application involved.
5. Electrical Devices: Make provisions and coordinate requirements for
electrical devices and connections for hardware.

B. Lock Trim: Furnish levers with rose or escutcheon plate, as required.

C. Through Bolts: Do not permit through bolts and grommet nuts on door faces in
occupied areas unless no alternative is possible.

D. Furnish all components with accessories as required for complete operational
installation.
1. Weatherstripping: Furnish continuous weatherstripping at top and sides of
exterior doors.
2. Fire Rated Gaskets: Furnish continuous fire rated gaskets at top and
sides of fire rated doors.
3. Thresholds: Maximum 1/2 inch height.

2.2 HINGES

A. Manufacturers:
1. Stanley Security Solutions, Inc., or approved equal.
   a. Standard Weight, Dry Interior Applications: Model FBB179.
   b. Standard Weight, Exterior and Wet/Damp Interior Applications:
      Model FBB191(32D).
   c. Heavy Weight, Dry Interior Applications: Model FBB168.

2. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Description: ANSI/BHMA A156.1, full mortise ball bearing type complying with following general requirements unless otherwise scheduled.
1. Widths: Sufficient to clear trim projection when door swings 180 degrees.
2. Number: Furnish as follows for each door leaf.
   a. Fire Rated Doors to 86 inches High: Minimum three (3) hinges.
3. Size and Weight:
   a. Doors 1-3/4 inch thick to 40 inches Wide: 4-1/2 inch size, heavy weight.
   b. Doors 1-3/4 inch Thick over 40 inches Wide: 5 inch size, heavy weight.
4. Pins: Non-removable pins (NRP) at exterior and locked outswinging doors, non-rising pins at interior doors.
5. Tips: Flat button tips with matching plug.

2.3 LOCKSETS, LATCH SETS AND CYLINDERS

A. Manufacturers:
1. Schlage Div., Ingersoll-Rand Co., L9000 Series with Type 03 Lever, or approved equal.
2. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Locksets: Furnish stainless steel locksets compatible with specified cylinders; 2-3/4 inch backset with 1-inch deadbolt; standard strikes with extended lips to protect trim from being marred by latch bolt; and roses or escutcheon plates as required.
1. Mortise Locksets: ANSI/BHMA A156.13, Series 1000, Grade 1 unless otherwise indicated.
2. Auxiliary Locksets: ANSI/BHMA A156.5, Grade 1, mortise dead locks unless otherwise indicated.

C. Latch Sets: Match locksets; 2-3/4 inch backset with 3/4-inch latchbolt; and standard strikes with extended lips to protect trim from being marred by latch bolt.
1. Mortise Latch Sets: ANSI/BHMA A156.13, Series 1000, Grade 1 unless otherwise indicated.

D. Cylinders: ANSI/BHMA A156.5, Grade 1, minimum 6-pin interchangeable core type cylinders.
1. Keying: Keying plan to be developed by NJ TRANSIT in consultation with Contractor’s hardware consultant.
2. Keys: Nickel silver. Stamp keys with “DO NOT DUPLICATE”.
3. Quantity: Supply minimum two (2) keys per lock; and minimum two (2) key blanks per cylinder type.
2.4 CLOSERS

A. Manufacturers:
   2. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Description: ANSI/BHMA A156.4, Grade 1, ADA-compliant surface mounted modern type with cover; full rack and pinion construction with adjustable steel spring, non-freezing hydraulic fluid, and low sensitivity captivated brass adjusting valves; closers required for fire rated doors unless otherwise indicated.
   1. Adjustability: Furnish controls for regulating closing, latching, speeds, and back checking.
   2. Arms: Type to suit individual condition; parallel-arm closers at reverse bevel doors and where doors swing full 180 degrees.
   3. Location: Mount closers on inside of exterior doors, room side of interior doors typical; mount on pull side of other doors.
   4. Operating Pressure: Maximum operating pressure as follows.
      a. Interior Doors: Maximum 5 pounds.
      b. Exterior Doors: Maximum 8 pounds.
      c. Fire Rated Doors: As required for fire rating.

2.5 DOOR CONTROLS AND OVERHEAD HOLDERS

A. Manual Door Holders and Overhead Stops:
   1. Manufacturers:
      b. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
   2. Description: ANSI/BHMA A156.16, Grade 1 aluminum type with hook attachment and non-marring rubber stop.

2.6 ACCESSORIES

A. Thresholds:
   1. Manufacturer:
      b. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
   2. Description: Special purpose bumper threshold with gasket allows for 3/8" door undercut. Aluminum finish, length to match door leaf.

B. Key Cabinet:
   1. Manufacturers:
      b. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
   2. Cabinet Construction: 16-gauge sheet steel construction, piano hinged door with resettable combination pushbutton lock.
3. Cabinet Size: Size for Project keys plus sufficient room to allow for 10 percent growth.
4. Key Hook Tags: Numbered plastic tags for key hook labeling.
5. Finish: Baked enamel, manufacturer’s standard finish.

2.7 FINISHING

A. Finishes: ANSI/BHMA A156.18; unless otherwise noted, furnish following finishes as indicated in door schedule on Drawings:
   1. Hinges:
      a. Exterior and Wet/Damp Interior Applications: BHMA 630 satin finish, or BHMA 626 brushed finish.
   2. Exterior Exposed and High Use Interior Door Hardware: BHMA 630, satin finished stainless steel.
   3. Closers: Finish appearance to match door hardware on same face of door.
   4. Thresholds: Finish appearance to match door hardware on exterior face of door.
      a. BHMA 628, satin aluminum, clear anodized.
   5. Other Items: Furnish manufacturer’s standard finishes to match similar hardware types on same door, and maintain acceptable finish considering anticipated use and BHMA category of finish.

2.8 HARDWARE SETS:

Group No. 1
1. Lockset: (1) Schlage - L9453/Combination deadbolt lockset/latchset with interchangeable core
2. Closer: (1) Sargent – 281 Powerglide
3. Hinges: (3) Stanley - Model FBB168 heavy weight hinges, stainless steel
4. Sill: (1) Pemko 2005-AT, 36” long
5. Provide Perimeter Weather-Stripping

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify doors and frames are ready to receive door hardware and dimensions are as indicated on shop drawings and required by manufacturer.

B. Verify electric power is available to power operated devices and is of correct characteristics.
3.2 INSTALLATION

A. Coordinate mounting heights with door and frame manufacturers. Use templates provided by hardware item manufacturer.

B. Mounting Heights from Finished Floor to Center Line of Hardware Item: Comply with manufacturer recommendations and applicable codes where not otherwise indicated.
   1. Locksets: 38 inch.
   2. Dead Locks: 48 inch.
   3. Top Hinge: Jamb manufacturer’s standard, but not greater than 10 inches from head of frame to center line of hinge.
   4. Bottom Hinge: Jamb manufacturer’s standard, but not greater than 12-1/2 inches from floor to center line of hinge.
   5. Intermediate Hinges: Equally spaced between top and bottom hinges and from each other.
   6. Hinge Mortise on Door Leaf: 1/4 inch. to 5/16 inch from stop side of door.

3.3 FIELD QUALITY CONTROL

A. Have Primary Hardware Manufacturer’s Representatives inspect installation and certify hardware and installation has been furnished and installed in accordance with manufacturer's instructions.

3.4 ADJUSTING

A. Adjust hardware for smooth operation. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.

B. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

C. Six-Month Adjustment: Approximately six months after the date of Substantial Completion, the Installer, accompanied by representatives of the manufacturers of latchsets and locksets and of door control devices, and of other major hardware suppliers, shall return to the Project to perform the following work:
   1. Examine and re-adjust each item of door hardware as necessary to restore function of doors and hardware to comply with specified requirements.
   2. Consult with and instruct NJ TRANSIT personnel in recommended additions to the maintenance procedures.
   3. Replace hardware items that have deteriorated or failed due to faulty design, materials, or installation of hardware units.
   4. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.
3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Do not permit adjacent work to damage hardware or hardware finish.

B. Clean adjacent surfaces soiled by door hardware installation.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item for Division 8.

END OF SECTION
SECT`ON 08800

GLAZING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes glass glazing for windows and glazed walls.

B. Related Sections:
   1. Section 07900 - Joint Sealers: Sealant and back-up material other than glazing sealants.
   2. Section 08511 - Rolled Steel Windows: Glazed windows.
   3. Section 08550 – Wood Windows

REFERENCES

C. American National Standards Institute:

D. American Society of Civil Engineers:

E. ASTM International:

F. Glass Association of North America:

1.2 PERFORMANCE REQUIREMENTS

A. Size glass to withstand dead loads and positive and negative live loads acting normal to plane of glass as calculated in accordance with NJUCC Building Subcode (2015 ICC International Building Code, as amended); and ASCE 7.

B. Limit glass deflection to 1/200 or flexure limit of glass with full recovery of glazing materials, whichever is less.
1.3 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Product Data:
   1. Glass: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
   2. Glazing Sealants, Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors where exposed.

C. Samples: Submit two samples 6 x 6 inch in size, illustrating each glass type.

D. Certificates: Certify products meet or exceed specified requirements.

E. Manufacturer's Certificate: Certify glass, meets or exceeds specified requirements.

F. Submit drawings, calculations, and certifications signed and sealed by a licensed NJ professional. If the manufacturer is unable to provide signed and sealed the calculations and drawings by a NJ Licensed Professional, then signed and sealed Drawings by a Licensed Engineer in the State of Manufacture is acceptable.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual and GANA Sealant Manual for glazing installation methods.

B. Maintain one copy of each document on site.

1.5 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience and approved by manufacturer.

1.6 PRE-INSTALLATION MEETING

A. Convene minimum one week before starting Work of this section.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not install glazing when ambient temperature is less than 50°F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.
PART 2 PRODUCTS

2.1 CLEAR GLAZING

A. Manufacturers:
   1. Viracon, Inc., “VH1 1-75” or approved equal.
   2. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Description: Clear Laminated Glass (Type SG-CL); ASTM C1172, Kind LHS, clear heat strengthened glass (Type FG-CH); with plastic interlayer.
   1. Inboard/Outboard Layers: Two plies of ¼-inch clear tempered glass.
   2. Plastic Interlayer: Polyvinyl butyral, minimum 0.060 inch thick.
   3. Reflective Coating: 0.67 shading coefficient with 75% nominal visible light transmittance, on Number 2 surface.

2.2 GLAZING ACCESSORIES

A. Elastomeric Glazing Sealants: ASTM C920, Type S, Grade NS, high-modulus structural silicone glazing sealant, Class and Use suitable for glazing application indicated; single component; solvent curing; capable of water immersion without loss of properties; non-bleeding, non-staining, cured Shore A hardness of 15 to 25; compatible with adjacent materials including glass, laminated glass core, insulating glass seals, and glazing channels; color as selected by Architect.

B. Glazing Splines and Gaskets: ASTM C864; resilient neoprene or silicone extruded shape to suit glazing channel retaining slot.

C. Pre-Formed Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; black color; size to suit application.
   1. Butyl Corner Sealant: ASTM C920 single component non-skinning butyl compatible with glazing tape; color to match tape.

D. Setting Blocks: ASTM C864; silicone, 80 to 90 Shore A durometer hardness, 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.

E. Spacer Shims: ASTM C864; neoprene or silicone, 50 to 60 Shore A durometer hardness, minimum 3 inch long x one half the height of glazing stop x thickness to suit application.

F. Glazing Clips: Manufacturer's standard type.
PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings for glazing are correctly sized and within acceptable tolerance.

B. Verify surfaces of glazing channels or recesses are clean, free of obstructions impeding moisture movement, weeps are clear, and ready to receive glazing.

3.2 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

3.3 INSTALLATION

A. Perform installation in accordance with manufacturer’s instructions, GANA Glazing Manual and ASTM C1193.

B. Exterior Dry Method (Tape and Gasket Spline Glazing):
   1. Cut glazing tape or spline to length; install on glazing pane. Seal corners by butting tape and sealing junctions with compatible butyl sealant.
   2. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.
   3. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
   4. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.
   5. Trim protruding tape edge.

C. Exterior Wet/Dry Method (Preformed Tape and Sealant) Installation:
   1. Cut glazing tape to length and set against permanent stops, 3/16 inch below sight line. Seal corners by butting tape and dabbing with compatible butyl sealant.
   2. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete continuity of air and vapor seal.
   3. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.
   4. Rest glazing on setting blocks and push against tape [and heel bead of sealant] with sufficient pressure to attain full contact at perimeter of pane or glass unit.
   5. Install removable stops, with spacer strips inserted between glazing and applied stops, 1/4-inch below sight line. Place glazing tape on glazing pane or unit with tape flush with sight line.
6. Fill gap between glazing and stop with elastomeric glazing sealant to depth equal to bite of frame on glazing, but not more than 3/8-inch below sight line.

7. Apply cap bead of elastomeric glazing sealant along void between stop and glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.4 FIELD QUALITY CONTROL

A. Monitor quality of glazing.

3.5 MANUFACTURER'S FIELD SERVICES

A. Glass and glazing product manufacturers to provide field surveillance of installation.

B. Monitor and report installation procedures, and unacceptable conditions.

3.6 CLEANING

A. Remove glazing materials from finish surfaces.

B. Remove labels after Work is complete.

C. Clean glass and adjacent surfaces.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item for DIVISION 8.

END OF SECTION
SECTION 09670
FLUID-APPLIED FLOORING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes fluid-applied flooring and base; accessories.

B. Related Sections:
   1. Section 03300 - Cast-in-Place Concrete.
   2. Section 07900 - Joint Sealers: Joint between base and wall surface.
   3. Section 14245 – Hydraulic Passenger Elevators

1.2 REFERENCES

A. American Concrete Institute:
   1. ACI 503 - Use of Epoxy Compounds with Concrete.

B. ASTM International:
   1. ASTM C307 - Standard Test Method for Tensile Strength of Chemical-
      Resistant Mortar, Grouts, and Monolithic Surfacings.
   2. ASTM C413 - Standard Test Method for Absorption of Chemical-
      Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer
      Concretes.
   3. ASTM C531 - Standard Test Method for Linear Shrinkage and Coefficient
      of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic
      Surfacings, and Polymer Concretes.
   4. ASTM C579 - Standard Test Methods for Compressive Strength of
      Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer
      Concretes.
   5. ASTM C580 - Standard Test Method for Flexural Strength and Modulus of
      Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings,
      and Polymer Concretes.
   6. ASTM C884 - Standard Test Method for Thermal Compatibility between
      Concrete and an Epoxy-Resin Overlay.
   7. ASTM C722 - Standard Specification for Chemical-Resistant Monolithic
      Floor Surfacings.
   8. ASTM C811 - Standard Practice for Surface Preparation of Concrete for
      Application of Chemical-Resistant Resin Monolithic Surfacings.
   9. ASTM C1028 - Standard Test Method for Determining the Static
      Coefficient of Friction of Ceramic Tile and Other like Surfaces by the
      Horizontal Dynamometer Pull-Meter Method.
   10. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent
        and Time of Burning of Plastics in a Horizontal Position.
        Plastics to Surface Abrasion.

1.3 SUBMITTALS

A. Submit under the requirements of the General Provisions for Construction.
B. Product Data: Submit data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.
C. Samples: Submit two samples, 2 x 2 inch in size illustrating color and pattern for each floor material for each color specified.
D. Manufacturer’s Certificate: Certify products meet or exceed specified requirements.
E. Manufacturer's Installation Instructions: Submit substrate preparation and material installation procedures, perimeter conditions requiring special attention, and environmental requirements.

1.4 CLOSEOUT SUBMITTALS

A. Submit under the requirements of the General Provisions for Construction.
B. Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.
B. Applicator: Company specializing in performing Work of this section with minimum five years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.
B. Store resin materials in dry, secure area.
C. Store materials for three days prior to installation in area of installation to achieve temperature stability.
1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain minimum temperature in storage area of 60 degrees F.

B. Maintain minimum/maximum ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

1.8 EXTRA MATERIALS

A. Supply 2 gal of flooring material, of each color selected.

PART 2 PRODUCTS

2.1 FLUID-APPLIED FLOORING

A. Manufacturers:
   1. Palma, Inc., PaliKrom 125, or approved equal.
   2. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Description: ASTM C722; 1/8-inch thick trowel broadcast, self-leveling, thermosetting epoxy, forming a waterproof membrane, colored with aggregate broadcast on base coat.
   1. Base Coats: Primer/membrane and broadcast coats; onyx blend color.
   2. Aggregate: Grade 28 quartz chips; and 20/40 mesh and 140 mesh graded silica.
   3. Top Coat: Epoxy, thermosetting; two coats; clear.

C. Performance:
   1. Compressive Strength: ASTM C579; 6,000 psi.
   2. Tensile Strength: ASTM C307; 1,500 psi.
   5. Water Absorption: ASTM C413; 1.0% maximum.
   6. Thermal Coefficient of Expansion: $40 \times 10^{-6}$ in/in°F.
   7. Flammability: ASTM D635; Self-extinguishing.
   8. Thermal Shock Resistance: ASTM C884; No cracking, warping, scaling or flaking through five (5) cycles.
   9. Coefficient of Friction: ASTM C1028; 0.5.
   12. Bond Strength: ACI 503; 175 psi (100% concrete failure).

2.2 ACCESSORIES

A. Substrate Filler: “PalmaFlex” joint filler and fiberglass tape.
PART 3 EXECUTION

3.1 EXAMINATION

A. Verify floor surfaces are smooth and flat with maximum variation as specified in Section 03300 and are ready to receive work.

B. Verify concrete floors have cured minimum 28 days, exhibit negative alkalinity, carbonization, and dusting, and are acceptable to flooring manufacturer.

C. Verify floor and lower wall surfaces are free of substances capable of impairing adhesion of adhesive and finish materials.

3.2 PREPARATION

A. Prepare surfaces in accordance with ASTM C811 and as otherwise required by manufacturer.

B. Remove ridges and bumps from substrate. Fill low spots, cracks, joints, holes, and other defects with substrate filler.

C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

D. Sawcut and chisel substrate at termination points, keying in to maintain minimum thickness of fluid applied flooring.

E. Tape at termination points and adjacent surfaces not to receive fluid applied flooring.

F. Clean substrate.

3.3 INSTALLATION

A. Accurately saw cut substrate to install divider strips straight and level where indicated.

B. Install recess frames for any floor openings with 1/8-inch lip.

C. Install cant or fillet strips as required at base of walls where flooring is to be extended up wall as base.

D. Apply each coat of flooring within thickness range required by manufacturer.

E. Finish to smooth level surface.

F. Remove masking tape prior to drying of fluid applied flooring.

G. Install flooring in recessed type floor access covers.
H. Fillet and cove 4 inches at vertical surfaces.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

A. Prohibit traffic on floor finish for 72 hours after installation.
B. Barricade area to protect flooring until cured.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.
B. Payment: The cost of this section shall be included in the lump sum bid item for DIVISION 9.

END OF SECTION
THIS PAGE INTENTIONALLY LEFT BLANK
SECTION 09900
PAINTS AND COATINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes surface preparation and field application of paints and other coatings.

B. Related Sections:
   1. Section 05120 – Structural Steel – New and existing exposed steel.
   2. Section 05312 – Metal Roof Deck – Painting of the underside of existing canopy and roof deck.
   3. Section 06200 – Finish Carpentry – Exterior wood trim

1.2 REFERENCES

A. ASTM International:

B. Painting and Decorating Contractors of America:
C. SSPC: The Society for Protective Coatings:
   1. SSPC – Steel Structures Painting Manual.
   2. SSPC-SP 2 – Hand Tool Cleaning.
   3. SSPC-SP 3 – Power Tool Cleaning.

1.3 DEFINITIONS
A. Conform to ASTM D16 for interpretation of terms used in this section.

1.4 SUBMITTALS
A. Submit under the requirements of the General Provisions for Construction.
B. Product Data: Submit data on finishing products.
C. Samples: Submit two paper chip samples, 2 x 2 inch in size illustrating range of colors available for each surface finishing product scheduled.
D. Manufacturer's Installation Instructions: Submit surface preparation procedures, application requirements, and substrate conditions requiring special attention.

1.5 CLOSEOUT SUBMITTALS
A. Submit under the requirements of the General Provisions for Construction.
B. Operation and Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.6 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.
B. Applicator: Company specializing in performing work of this section with minimum five years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.
B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
C. 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.
D. Paint Materials: Store at minimum ambient temperature of 45°F and maximum of 90°F, in ventilated area, and as required by manufacturer's instructions.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint product manufacturer.

B. Do not apply exterior coatings during rain or snow when relative humidity is outside humidity ranges, or moisture content of surfaces exceed those required by paint product manufacturer.

C. Minimum Application Temperatures for Latex Paints: 45°F for interiors; 50°F for exterior; unless required otherwise by manufacturer's instructions.

D. Minimum Application Temperature for Lacquers and Varnishes: 65°F for interior or exterior, unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 50 foot-candles measured mid-height at substrate surface.

1.9 WARRANTY

A. Furnish five year manufacturer warranty for paints and coatings.

1.10 EXTRA MATERIALS

A. Supply 5 gallons of each color and type; store where directed.

B. Label each container with color, type, and room locations in addition to manufacturer's label.

PART 2 PRODUCTS

2.1 PAINTS AND COATINGS

A. Metal Primer:
   1. Manufacturer:
      b. Other manufacturers offering equivalent products:
         2) MAB Paints, “Hydro Prime” 073-189.
         3) Benjamin Moore & Co., Acrylic Metal Primer M04.
      c. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
   2. Description: Water-based, rust inhibitive, single component, VOC compliant, self cross-linking acrylic primer.
a. Finish: Low Sheen.
b. Color: White, Gray or Red Oxide.
c. Solids: 39% (+/- 2%) by volume; 53% (+/- 2%) by weight.
e. Flash Point: >200°F, Seta Flash.
g. Corrosion Resistance: ASTM D5894, 10 cycles, 3,360 hours.
h. Impact Resistance: ASTM D2794, >140 lbs.
i. Heat Resistance: ASTM D2485, 200°F.
k. Condensation Resistance: ASTM D4585, 100°F, 1,250 hours.
l. Pencil Hardness: ASTM D3363, H.
m. Salt Fog Resistance: ASTM B117, 1,250 hours.

B. Metal Finish:
1. Manufacturer:
   b. Other manufacturers offering equivalent products:
      2) MAB Paints, “Rust-O-Lastic” 043.
   c. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

2. Description: Water-based, ambient cured, chemical resistant, rust inhibitive, single component, VOC compliant, acrylic coating.
   b. Color: As selected by Architect.
   c. Solids: 38.5% (+/- 2%) by volume; 51% (+/- 2%) by weight.
   e. Flash Point: >230°F, Seta Flash.
   g. Corrosion Resistance: ASTM D5894, 10 cycles, 3,360 hours.
   h. Impact Resistance: ASTM D2794, >100 lbs.
   i. Heat Resistance: ASTM D2485, 300°F.
   j. Flexibility: ASTM D522, 180° bend, 1/8" mandrel.
   k. Condensation Resistance: ASTM D4585, 100°F, 1,250 hours.
   l. Pencil Hardness: ASTM D3363, 2B.
   m. Salt Fog Resistance: ASTM B117, 1,250 hours.

C. Masonry Primer:
1. Manufacturer:
   b. Other manufacturers offering equivalent products:
      2) MAB Paints, “Block Kote”.
   c. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

2. Description: Water-based interior/exterior latex primer/filler.
   a. Finish: Flat.
   c. Solids: 48% (+/- 2%) by volume; 68% (+/- 2%) by weight.
   d. VOC: 0.37 lbs/gal, EPA Method 24.
   e. Flash Point: N/A.

D. Exterior Masonry Finish:
1. Manufacturer:
   b. Other manufacturers offering equivalent products:
      2) MAB Paints, “Design Accents” 180100.
   c. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

2. Description: Water-based exterior vinyl acrylic latex coating.
   a. Finish: Flat.
   b. Color: As selected by Architect.
   c. Solids: 34% (+/- 2%) by volume; 52% (+/- 2%) by weight.
   d. VOC: 0.41 lbs/gal, EPA Method 24.
   e. Flash Point: N/A.

E. Gypsum Wall Board Primer:
1. Manufacturer:
   b. Other manufacturers offering equivalent products:
      2) MAB Paints, “Prime Fast”.
   c. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

2. Description: Water-based interior latex primer.
   a. Finish: Flat.
   c. Solids: 28% (+/- 2%) by volume; 44% (+/- 2%) by weight.
   d. VOC: 0.76 lbs/gal, EPA Method 24.
   e. Flash Point: N/A.
F. Gypsum Board Ceiling Finish:
1. Manufacturer:
   b. Other manufacturers offering equivalent products:
      1) PPG Architectural Finishes, “Speedhide” Series 6-76.
      2) MAB Paints, “Design Accents” 180100.
   c. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
2. Description: Water-based interior vinyl acrylic latex coating.
   a. Finish: As selected by Architect.
   b. Color: As selected by Architect.
   c. Solids: 32% (+/- 2%) by volume; 52% (+/- 2%) by weight.
   d. VOC: 0.81 lbs/gal, EPA Method 24.
   e. Flash Point: N/A.

G. Opaque Wood Finish:
1. Manufacturer:
   a. Sherwin Williams Co., “Pro Industrial 0 VOC Acrylic”
2. Description
   a. Finish: As selected by Architect.
   b. Color: As selected by Architect.
   c. Solids: 87% (+/- 2%) by volume; 92% (+/- 2%) by weight.
   d. VOC: Unreduced <100 g/L; <0.83 lb/gal
   e. Flash Point: 101°F, PMCC

2.2 OTHER COMPONENTS
A. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve finishes specified; commercial quality.
B. Patching Materials: Latex filler.
C. Fastener Head Cover Materials: Latex filler.

PART 3 EXECUTION
3.1 EXAMINATION
A. Verify substrates are ready to receive Work as instructed by product manufacturer.
B. Examine surfaces scheduled to be finished prior to commencement of work. Report conditions capable of affecting proper application.
C. Test shop applied primer for compatibility with subsequent cover materials.
D. Measure moisture content of surfaces using electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Plaster and Gypsum Wallboard: 12 percent.
2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
3. Concrete Floors: 8 percent.

3.2 PREPARATION

A. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

B. New Surfaces: Correct defects and clean surfaces capable of affecting work of this section.

C. Existing Surfaces: Prepare all surfaces in accordance with SSPC-SP 2 or SSPC-SP 3, as required to remove blistered or flaking existing paint, oil, dust, grease, dirt, rust or other deleterious materials that would impair coating adhesion.

D. Marks: Seal with shellac those that may bleed through surface finishes.

E. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or scraping; clean by washing with solvent suitable for use with acrylic latex primer and finish coatings. Apply treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.

G. Shop Primed Steel Surfaces: 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.

H. Metal Doors Scheduled for Painting: Prime metal door top and bottom edge surfaces.

I. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

J. Concrete Floors: Refer to Section 09670.

K. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
3.3 EXISTING WORK
A. Extend existing paint and coatings installations using materials and methods compatible with existing installations and as specified.

3.4 APPLICATION
A. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
B. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless specified otherwise.
C. Sand metal surfaces lightly between coats to achieve required finish.
D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

3.5 FIELD QUALITY CONTROL
A. Inspect and test questionable coated areas in accordance with Steel Structures Painting Manual.

3.6 CLEANING
A. Collect waste material which may constitute fire hazard, place in closed metal containers, and remove daily from site.

3.7 SCHEDULE - EXTERIOR SURFACES
A. Steel - Unprimed:
   1. One coat of acrylic latex primer, 2.0-4.0 mils dft/ct.
   2. Two coats of gloss acrylic latex enamel, 2.5-4.0 mils dft/ct.
B. Steel - Shop Primed:
   1. Touch-up with acrylic latex primer.
   2. Two coats of gloss acrylic latex enamel, 2.5-4.0 mils dft/ct.
C. Masonry Block
   1. One coat of primer sealer latex.
   2. Two coats of latex enamel, flat.

3.8 SCHEDULE - INTERIOR SURFACES
A. Steel - Unprimed:
   1. One coat of acrylic latex primer, 2.0-4.0 mils dft/ct.
   2. Two coats of gloss acrylic latex enamel, 2.5-4.0 mils dft/ct.
B. Steel - Shop Primed:
1. Touch-up with acrylic latex primer.
2. Two coats of gloss acrylic latex enamel, 2.5-4.0 mils dft/ct.

C. Masonry Block:
1. One coat of primer sealer latex.
2. Two coats of latex enamel, semi-gloss.

D. Concrete Floors: Refer to Section 09670.

E. Gypsum Board Ceilings:
1. One coat of alkyd primer sealer.
2. Two coats of latex acrylic enamel, flat.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item for DIVISION 9.

END OF SECTION
SECTION 10523
FIRE EXTINGUISHERS AND CABINETS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes: Fire extinguisher and brackets for wall mounting.

B. Related Sections:

1.2 REFERENCES

A. National Fire Protection Association:
   1. NFPA 10 - Standard for Portable Fire Extinguishers.

B. Underwriters Laboratories Inc.:
   1. UL - Fire Protection Equipment Directory.

1.3 PERFORMANCE REQUIREMENTS

A. Conform to NFPA 10.

B. Provide extinguishers [and cabinets] classified and labeled by Underwriter’s Laboratories, ETL/Intertek, Factory Mutual, Warnock-Hersey, or other testing firm acceptable to the authority having jurisdiction for purpose specified and indicated.

1.4 SUBMITTALS

A. Submit under the requirements of the General Provisions for Construction.

B. Shop Drawings: Indicate cabinet physical dimensions, wall bracket mounted measurements, location and fire ratings.

C. Product Data: Submit extinguisher operational features, color and finish, anchorage details.

D. Manufacturer’s Installation Instructions: Submit special criteria and wall opening coordination requirements.

E. Manufacturer’s Certificate: Certify Products meet or exceed specified requirements.
1.5 CLOSEOUT SUBMITTALS
A. Submit under the requirements of the General Provisions for Construction.
B. Operation and Maintenance Data: Submit test, refill or recharge schedules and re-certification requirements.

1.6 ENVIRONMENTAL REQUIREMENTS
A. Do not install extinguishers when ambient temperature is capable of freezing extinguisher ingredients.

PART 2 PRODUCTS
2.1 FIRE EXTINGUISHERS
A. Manufacturers:
   1. Kidde, Model “Pro 10 CD Fire Extinguisher”
      Kidde Residential & Commercial Division
      1016 Corporate Park Drive
      Mebane, NC 27302
      Main Office: 919-563-5911
   2. Approved Equal
   3. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
B. Carbon Dioxide Type: Cast steel 10lb tank, with pressure gage.
C. Extinguisher Finish: Painted Steel

2.2 ACCESSORIES
A. Extinguisher Brackets: Formed steel

PART 3 EXECUTION
3.1 EXAMINATION
A. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION
A. Secure rigidly in place.
B. Place extinguishers on wall brackets.
PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item for DIVISION 10.

END OF SECTION
SECTION 14240
HYDRAULIC ELEVATOR

PART 1 - GENERAL

1.1 DESCRIPTION

1. This Section specifies requirements for renovation of two direct plunger hydraulic elevators at NJ Transit / New Brunswick Train Station, New Jersey.

1.2 APPLICABLE CODES, STANDARDS AND PUBLICATIONS

1. American National Standards Institute (ANSI)
   1. ASME A17.1 2013 Elevators and Escalators or as required by New Jersey building codes
   2. ANSI A117.1 2009 Americans Disabilities Act Accessibility Guidelines (ADAAG)
   3. ASME A17.5 Elevator and Escalator Electrical Equipment or as required by New Jersey building codes

2. National Fire Protection Association (NFPA)
   1. NFPA 70 2014 National Electrical Code or as required by New Jersey electrical codes.

3. Americans with Disabilities Act (ADA)

4. American Public Transportation Association (APTA)

5. American Welding Society (AWS)

6. National Elevator Industry (NEII)

7. American Society of Testing and Material (ASTM)

8. National Electrical Manufacturers Association (NEMA)
9. Occupational Safety and Health Administration (OSHA)
10. Underwriters Laboratories (UL)
11. ISO 281/I-1997
12. American Gear Manufacturers Association (AGMA)
13. Well Construction and Maintenance (N.J.A.C.7 :9D)
14. Any additional requirements imposed by local agencies shall be incorporated.
15. In case of a conflict between codes, regulations, or standards, the most stringent requirement shall take precedence.
16. In addition any specific provisions cited herein and shown on the contract drawings shall govern for the associated specified application.

1.3 OPERATION AND MAINTENANCE MANUALS

1. Provide a separate and unique set of Operation and Maintenance Manuals for these elevators.

2. Three (3) sets of the O&M Manuals labeled “Final” shall be submitted for approval within 30 days after the elevator successfully completes field-testing and inspections. The wiring diagram volumes of the installed elevator shall include As-Built wiring diagrams. Finalized versions of the manuals shall contain no addenda, corrections or alterations and represent the As-Built conditions. Upon approval of the Final manual volume, the Contractor shall provide three (3) manuals to the Engineer.

3. The Operation and Maintenance Manuals shall cover all mechanical and electrical equipment installed under this Section. Manuals shall contain sufficient descriptive and pictorial detail for complete disassembly, reassembly and testing of each component part of the elevator. Each component on the wiring diagram must be properly identified, and the value of the component (i.e.: ohm, VA) indicated near it. No tables of the components will be accepted as a substitute for the above individual identification.
4. The manual shall contain a list of all elevator parts, including individual components, assemblies and sub-assemblies. The list shall include the following information:

   1. Nomenclature of parts
   2. Elevator manufacturer’s part number
   3. Nomenclature of the next higher assembly in which the part is used
   4. Original vendor part number, or DIN number, if applicable

5. The O&M Manuals shall include a list of the elevator manufacturer’s preventive maintenance procedures, along with the time interval at which each procedure shall be performed. The list of preventive maintenance procedures shall include, but not be limited to:

   1. Lubrication
   2. Oil Changes
   3. Adjustments
   4. Testing
   5. Cleaning

6. The outside cover of each binder shall be clearly labeled with the manual title, location, elevator designation and Contract title and number. Each binder shall contain a table of contents. Sections shall be tabbed separately. Original catalogues may be used to supplement, but not to replace, the lists described above. Wiring diagrams shall be a minimum of 11 X 17.

7. Material Safety Data Sheets (MSDS) and product data sheets: Shall be submitted thirty (30) days prior to starting of work, also include an index listing each product.

   1. Provide the approved data sheets in the Final version of the O & M Manuals.

8. Documentation and Updates:

   1. Obtain from the elevator manufacturer(s) for the benefit of NJ Transit, certification that the manufacturer shall provide NJ Transit with copies of all documents related to maintenance, safety, operations, design changes, modifications, retrofits, etc., which relate to any part, component, equipment, system, subsystem, or material and services applicable to the elevator provided. All of the above referenced shall be provided as it pertains to the original
installation and for a period of ten (10) years after issuance of Certificate of Final Completion.

2. Submit to county a certificate of agreement for maintenance service as specified herein. Include the name and business telephone number of the entity who shall perform such maintenance service.

1.4 QUALITY ASSURANCE

1. Manufacturer’s Qualification: Verify that the manufacture has been regularly engaged for the past five years in the manufacture of major components for hydraulic elevators.

2. Welding: Welding shall be performed in accordance with the requirements of AWS or CWB. Welders shall produce evidence of current certification by AWS or CWB.

3. Installer’s Qualifications: Verify that the Installer is a manufacturer’s representative or authorized agent of elevator equipment manufacturer for the products to be installed.

4. Upon request arrange for the Engineer to inspect elevator and elevator equipment for shipping/installation.

5. Ensure firms performing elevator work are members of the National Elevator Industry, Inc. (NEII), or the National Association of Elevator Contractors (NAEC), or as approved by the Engineer.

1.5 DELIVERY, STORAGE, AND HANDLING

1. Store materials in original protective packaging in a dry and protected area.

2. Protect equipment exposed finishes during transportation storage and erection against damage and stains.

3. Deliver components with factory-installed wooden skids and lifting lugs; pack components in factory-fabricated protective containers.

4. Handle components carefully to avoid damage to components, enclosures and finish.
5. Store components in clean, dry areas and protect them from weather. Storage shall be in areas designated by the Engineer.

6. Comply with the manufacturer’s rigging instructions for unloading components; and moving components to their final location for installation.

1.6 SPARE PARTS, AND SPECIAL TOOLS

1. Provide a list of spare parts required for maintenance and operation of the elevator equipment installed under this contract. The contractor shall maintain these spare parts on site at all times.

2. Provide a list of each printed circuit board that is needed to fully operate the elevator and its safety circuits. The contractor shall maintain these spare circuit boards parts in inventory and have available for delivery to the job within twenty four (24) hours.

3. Provide to NJT all special tools required for the operation and maintenance of the elevator, prior to use by the general public. Provide the following to NJT.

1. Any diagnostic tools or devices that is required for maintenance, inspection, testing or troubleshooting (one set).
2. Passenger/Maintenance Barrier (one set)
3. Keys (two keys per every lock installed)
4. Nylon gibs for top of car reader, if used :(12)
5. Parts cabinet for each motor room.
6. Tape head sensor, one for each type furnished.
7. Replacement jack seals: 2 kits
8. Two oil cooler filters.

1.7 GUARANTEES

1. Notwithstanding the Specifications forming a part of this Contract, any inspection or approval of the Work by NJ Transit, or the existence of any patent or trade name, the Contractor nevertheless unconditionally guarantees that the equipment furnished and installed hereunder shall be of the best quality and shall be fully fit for the purpose for which it is to be used. The Contractor unconditionally guarantees all equipment furnished and installed by it against defects or failures of any kind, including defects or failures in design, workmanship and materials, and against failures to operate satisfactorily for any reason, excepting such defects or failures which the Contractor demonstrates to the satisfaction of the Engineer.
have arisen solely from accident, abuse occurring after the acceptance of the elevator and due to no fault on the Contractor’s part, for a period of one (1) year from the date of issuance of Certificate of Final Completion. In the event of defects or failures in said equipment, then upon receipt of notice thereof from NJ Transit, the Contractor shall correct such defects or failures by immediately reconstructing, repairing or making such alterations to or replacement of said equipment as may be necessary or desirable in the sole opinion of NJ Transit to comply with above guarantee.

2. The warranties shall include materials, shipping, special equipment, protection, travel costs, and labor necessary to correct any defects.

3. Defects shall include, but not be limited too the following: noisy, rough or substandard operation; loose, damaged, and missing parts; and fluid leaks.

1.8 MAINTENANCE SERVICE

1. Provide regular examinations, adjustments and lubrication of the elevator equipment for a period of one (1) year after issuance of Certificate of Final Completion. Arrange for this service to be performed by the elevator subcontractor/installer. Ensure that all work is performed by competent employees during regular working hours of regular working days and shall include emergency 24-hour callback service at no extra cost. Callback service shall include arrival of a mechanic within two (2) hour of a service call, except should the service call involve a trapped passenger; the response time will be within one hour.

2. This service shall not cover adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents caused by persons other than the Contractor, his subcontractors, and suppliers. Only genuine parts and supplies as used in the manufacture and installation of the original equipment shall be provided.

3. Provide complete service and maintenance of the elevator and related components including electrical control systems during the maintenance period as follows:

1. Tasks:

1. Inspect and periodically test the elevator system, in accordance with the O & M Manual requirements and the
1. Code to maintain the elevator in a completely operable condition.

2. Operate the elevator at least monthly for a minimum of two (2) hours, observing the elevator’s operational functions and ride quality. Provide monthly documentation of the same to the engineer.

3. Periodically lubricate the parts and equipment components as per the approved O & M Manuals. Charts are to be provided for elevator indicating when services are provided in the machine room.

4. Perform work without removing the elevator from service during peak traffic periods as established by the engineer.

5. Provide a clean-down of the elevator and hoistway enclosures just prior to the end of the maintenance period. Make necessary arrangements with the county in order to minimize any inconvenience.

2. Reporting: Detailed monthly records of tasks performed including names of individuals performing the tasks, date, and time performed and other pertinent data.

3. Cleaning: Includes a written cleaning procedure for the exterior of car enclosures including glass or hoistway enclosures. The instructions shall be kept on the premises where the elevator is located.

1.9 DESIGN CRITERIA

1. Operational Requirements

1. Hours of operation shall be considered as sixteen (16) hours per day, seven (7) days per week, with 120 starts per hour.

2. Rated Speed shall be 100 feet per minute (FPM) under all load conditions.

1.10 ENVIRONMENTAL REQUIREMENTS
1. Sound Level: Elevator shall be designed to operate at or below a sixty-five (65) decibels sound level, measured five (5) feet above the elevator cab floor at any location, with the elevator operating normally, either free running or under load.

2. Elevators shall be designed to operate while exposed to the elements of weather, including sunlight, rain, slush, snow and ice; all conditions of related humidity while exposed to salt, de-icing chemicals, airborne dust, and debris, and corrosive elements; and in a dry bulb temperature range of minus ten (10) to plus one hundred and five (+105) degrees Fahrenheit.

1.11 COORDINATION REQUIREMENTS

1. Alterations: Coordinate with the Engineer any alterations required to accommodate the elevator.

2. Floor finish in cab: Coordinate with other appropriate contractors and/or trades.

3. Pit Drainage / Sump Pit: Coordinate with other appropriate contractors and/or trades the means to prevent water from accumulating in the elevator pit.

4. Electrical: Coordinate the locations of all disconnect switches, outlets, lights, and the auxiliary contacts for battery lowering, smoke detection, and shunt trip.

5. Safety Training: Provide documentation to the engineer listing any employee(s) working on this project, that they have had a minimum of eight (8) hours safety training within the last twelve (12) months.

6. Lock Cylinders: All locks and keys shall be as per Engineer approval.

7. All hardware must be: galvanized, stainless steel or zinc di-chromium coated only.

1.12 SUBMITTALS

1. Submit manufacturer’s product data and samples 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. Piping schematics for all hydraulics. Piping between pumps and jack units.


2. Complete detailed shop drawings of the elevators including motors and other equipment used in the installation of the elevator and the following:

   1. Complete detailed shop drawings of the elevator including pumps, wiring, piping, cylinder, plunger and other equipment used in the installation of elevator.

3. Complete assembly detail of casing, cylinder, and plunger, with all load calculations.

   1. Car, guide rails, buffers and other components in hoistway.

   2. Complete assembly detail of structural members and all load calculations.

   3. Clearances and travel of car.


   5. Location and sizes of access doors, hoistway entrances and frames.

   6. Car and Hall fixtures.

   7. Elevator cabs.

4. Samples of materials and products requiring color or finish selection.

1. Furnish three (3) copies of maintenance manual incorporating the following:

1. Description of elevator system’s method of operating and control including motor control system, door operation, signal, firefighter’s service, emergency power operation, and special or non-standard features provided.

2. Parts catalogs giving complete list of replacement parts with cuts and identifying numbers.

3. Provide recommended spare parts list.

4. Legible schematic wiring diagrams covering electrical equipment as supplied and installed, including as-builts.

5. Lubrication and maintenance requirements.

6. Complete description and demonstration of all diagnostic procedures and equipment such as adjustments checking disassembly and repair problem solving, and scheduling of pneumatic maintenance procedure.

7. Recommended cleaning agents and methods including cautions against detrimental agents and methods.

2. Submit to NJ Transit a certificate of agreement for maintenance service required as specified herein. Include the name and business telephone number of the entity who shall perform such maintenance service.

3. Certification: The elevator manufacturer shall provide to the owner, certification that the owner of the elevator shall be provided with copies of all documents related to maintenance, safety, operations, design changes, modifications, retrofits etc., which relate to any part, component, equipment, system, subsystem, or material and services applicable to the elevator provided.

4. All of the above referenced shall be provided as it pertains to the original installation and for a period of ten (10) years after final acceptance of the last elevator provided under any contract.
5. The elevator manufacturer shall provide the referenced material within thirty (30) days of publication or internal distribution. The material, even if labeled PROPRIETARY, shall be delivered to the AUTHORITY without prejudice or delay and at no additional cost.

6. Provide all material on CD-ROM in a format approved by NJ Transit.

7. Material Safety Data Sheet (MSDS) and product data sheets: Shall be submitted with an index listing each product, along with the application method of the product, approximate quantity of product per elevator, and the component the product is applied to or associated with. The contractor shall allow 6 (six) weeks for review of MSDS.

1.13 RELATED WORK BY OTHERS

1-Install side spray sprinklers in pit.
2-Install fused disconnect with micro switch for battery power.
3-Provide fused 110 volt lighting disconnect.
4-Provide pit lighting with switch and GFCI receptacle.
5-Provide non GFCI receptacle in pit for sump pump.
6-Provide pit sump pump per code.
7-Provide guarded motor room lighting fixtures.
8-Provide gfci receptacle in motor room.
9-Provide adequate hoist beam in shaft.
10-Provide sill supports.
11-Provide dedicated phone line to controller.
12-Provide code required fire alarm devices in shaft and motor room.
13-Provide sump pump pit with cover.
14-Provide sump pump with oil minder.
15-Provide motor room AC unit.
16-Grout sills.
17-Provide power for oil cooler and heater.
18-Provide piping from main line and 110 volt disconnects to controller.
19-Provide sill and oil line heater tracing power.
20-Cut brickwork to set all fixture boxes, and finish brickwork when boxes are set.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. Subject to compliance with the requirements of this Section, provide hydraulic elevators of one of the following manufacturers:

   1. Minnesota Elevator Co.
   2. Canton Elevator Co.
   3. Leistritz AG Elevator Co.
   4. Or approved equal

2. Elevator Cabs shall be provided by one of the following suppliers:

   1. EDI / ECI
   2. National Cab & Door
   3. Velis Associates
   4. Or approved equal

3. The Elevator Controller to be PLC based and compatible with New Jersey Transit Remote Control and Monitoring System. Controller shall conform to the requirements detailed in part 2.04.W of this section.

   Controllers to be provided by one of the following suppliers:

   1. Claddaugh Electronic
   2. Virginia Controls
   3. Or approved equal

4. Door operator and hoistway door equipment

   1. G.A.L.
   2. Or approved equal

5. Epoxy floor covering for cab interior

   1. Crown Polymers
2. Or approved equal

6. Fixtures
   1. C.J. Anderson
   2. Or approved equal

2.2 MATERIAL

1. Except where product conformance to specific standards is indicated on the Contract Drawings and in ASME/ANSI A17.1, manufacturer’s standard materials and equipment may be used in elevator construction, subject to approval. Materials cited below are intended to establish the standard of quality for comparable materials used by the manufacturer.


3. Sheet Steel: ASNI/ASTM A446, Grade B

4. Stainless Steel: ASTM A167, Type 316L, with No. 4 finish.


6. Transparent Glazing Panels: 9/16 inch (14 mm) minimum laminated safety glass conforming to the requirements of ANSI Z97.1 and 16CFR Part 1201. Markings as specified in the applicable glazing standard shall be on each separate piece, and shall remain visible after installation.

7. Cab Flooring: Non-Slip epoxy Finish Floor as approved by NJ Transit.

2.3 CONSTRUCTION FEATURES

1. Elevator shall be of size, arrangement, capacity and shall comply with design criteria specified in this Section and as shown on the Contract Drawings, and in accordance with the requirements of the ASME 17.1 2013 with Addenda’s.

2. Provide all material and equipment necessary for the complete execution of all elevator work as specified in this Section and as shown on the Contract Drawings.

3. Elevators shall conform to the requirements of NEII "Suggested Minimum Passenger Elevator Requirements for the Handicapped".
4. All electric equipment, conduit, fittings and wiring be NEMA 4X, and shall conform to the requirements of the National Electrical Code NFPA-70 – 2014, NFPA-130 Fixed Guideway Transit and Passenger Rail System, and New Jersey Electrical Codes.

5. Provide concrete inserts and other similar anchoring devices for the installation of guide rails, machinery and other elevator components.

6. Clearance around equipment located in each elevator machine/pump and controller room shall comply with the applicable provisions of the National Electrical Code and any other Code that would apply.

7. Equip the elevator with a hands free maintenance communication system that provides for communication from within the elevator car enclosure and machine/pump/controller room.

2.4 DESIGN

1. Elevator Type: Direct Plunger (in ground) Type Hydraulic Elevators, to function as an ADA compliant passenger elevators.


3. Car Speed (with full load): 100 fpm.

4. Travel Height: As shown on contract drawings

5. Car Inside Size:
   5’-8” Wide x 5’ 41/2” Deep or as shown on contract drawings

6. Landings Served:
   Eastbound 2 (In line) Westbound 2 (Opposite).

7. Operation: Selective/Collective


9. Lighting and Signal Supply: 120V, 60Hz, 20A

10. Motor Horse Power: Eastbound 30 (HP) /Westbound 40(HP)

11. Machine Room Location: As shown on contract drawings
12. Car and Landing Doors: Single speed side slide

13. Cab height: 8’ feet 0 inches (inside dimension)


15. Maintenance Term: One (1) year after Final acceptance.

16. Hoistway Equipment

   1. Guide Rails and Brackets
      1. Provide new steel T-section rails. Rail surfaces shall be machined smooth to insure proper operation of guides. Rail ends shall be accurately machined with tongue and matching groove centrally located on web.
      2. Guides shall be joined and installed in accordance with the Code. Guide Rails attachments shall be designed for proper seismic requirements.
      3. Provide properly mounted galvanized guide rail brackets, mounted to shaft wall.

   2. Car Buffers: Spring type with blocking and support.

   3. Pit Stop Switch: A new enclosed stop switch, mounted in the pit of each elevator in accordance with the Code, shall prevent operation of the elevator when switch is activated. Switch shall be of the type described in the Code.

   4. Terminal Limits: Limit switches shall slowdown and stop the car at the terminals if the primary automatic stopping system fails.

   5. Scavenger Pump:
      1. Provide a Wagner Model # 091140 positive displacement, rotary type oil return scavenger pump or approved equal with a in line check value. Mount the scavenger pump off the pit floor and connect it to the jack unit and the oil tank with
copper tubing. Unit shall be capable of pumping Oil 100’ in height.

2. The pump shall be self-priming and self lubricating and be equipped with a check valve and a 100 mesh screen strainer.

3. The pump housing shall be constructed of brass with stainless steel internal parts. The scavenger pump tank shall be furnished with a clear Lexan lid.

4. The pump unit shall be mounted off the floor.

5. The oil return line shall be copper tubing and connected to the jack units and the oil tank unit. The copper tubing shall be securely attached for support and to prevent damage.

6. Unit shall be able to detect water in the system and prevent pumping water into the oil tank reservoir.

17. Drive System

1. General: Provide a hydraulic drive system. The drive system shall consist of a hydraulic power unit and jack assembly capable of lifting the gross load to the height indicated in the Contract Drawings. Submersible pumps motors will not be permitted. The motor and pump shall be designed specifically for hydraulic elevator operation. The maximum operating pressure shall not exceed 400 psi.

2. Hydraulic Power Unit: The hydraulic power unit shall be of compact design suitable for operation under the required working pressure, not to exceed 400 p.s.i. measured at the pump. The pump unit shall not be mounted in the hydraulic-fluid storage tank. The pump shall be driven with a one piece multi-groove V-belt. The direction 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 shall be provided with a muffler and a low-pressure switch. Provide a single lever ball type shut-off valve in both the machine room and the elevator pit.
1. Included in the reservoir shall be an oil fill strainer with air filter and a self-cleaning strainer in the suction line.

2. The tank shall have a reserve capacity of not less than 10 gallon and sight glass with markings for minimum and maximum oil level.

3. Cold weather exercise cycle: Should the elevator remain idle for two hours, the elevator controller shall automatically cycle the elevator through its full range of travel two times without operating the doors.
   a. Cycle intervals and number of round trips per cycle: User adjustable with default of two round trips after two continuous idle hours. (maximum). Or as otherwise recommended by the elevator manufacturer to prevent sluggish operation.
   b. User adjustable settings 2-8 hour cycle with or without doors.

18. Motor:

   1. Motor shall be of the drip-proof, squirrel cage, induction type complying with NEMA Design D torque classification, Class B insulation and be designed for 120 starts per hour.

   2. Motor shall have reduced voltage starting and shall be of energy efficient soft start and low noise operation.

   3. Motor shall be of heavy-duty construction and shall be designed for hydraulic elevator service with intermittent duty cycle rating.

   4. Motor shall be provided with starter and thermal overload protection for each phase.

   5. Motor shall be labeled by the manufacturer with NEMA minimum efficiency marking standard in accordance with NEMA MG-1-12.53b.

19. Hydraulic Oil Pump: Hydraulic oil pump shall be of the heavy-duty positive displacement type, designed for steady discharge with minimum pulsations. Pump shall be belt or direct driven by the electric motor.

20. Hydraulic Oil Control Unit: Hydraulic oil control unit design shall be suitable for operation under the required pressures and shall perform all necessary functions for safe and proper hydraulic elevator operation. Unit shall be fully adjustable to optimize elevator performance and smooth
operation. Adjustments shall be accessible and made without removing unit from oil lines. Unit shall be a single compact assembly of the following:

1. Main valve section shall consist of bypass, lowering and check valves to control down speed and up and down leveling. Check valves shall comply with the Code.

2. Control section shall consist of solenoid valves that direct the main valve section and control up and down starting, transition from full speed to leveling speed, up and down stops, pressure relief valve, manual lowering valve.

3. Relief valve shall comply with the Code.


21. Hydraulic Oil Tank:

1. Hydraulic oil tank shall be of the atmosphere storage and discharge type sized to store the volume of oil required to lift the elevator car to the top landing, plus additional 10 gallon reserve capacity to prevent the entrance of air or other gas into the hydraulic system. Provide all initial supply of oil sufficient for proper operation.

2. Tank shall be designed and constructed to meet or exceed the factor of safety requirements of the Code.

3. Tank shall be equipped with a removable cover, protected vent opening, drain valve, filter screen over suction inlet, tank heater and at least one oil level gauge glass. Oil level gauge glass shall comply with the Code.

4. Provide Shut off values as per contract drawings.

5. Provide oil tank cooler and heater

22. Jack Assemblies

1. Jack assembly shall consist of a plunger and cylinder of ASTM A53, Grade B, extra heavy steel pipe and shall comply with all applicable requirements of the Code.
2. Jack assemblies shall be connected to hydraulic oil piping to form a single hydraulic system. Cylinder head shall be self-adjusting with leak proof packing. Provide connection for a scavenger line to return hydraulic oil seeped from packing back to tank and means shall be provided on cylinder for air and gas relief.

3. Provide a pressure sensitive, mechanically actuated seismic safety valve(s), conforming to ASME A17.1. Connect valve directly to jack assembly inlet.

4. A schedule 40 watertight steel drill casing shall be provided. The drill casing shall be installed plumb so that the hydraulic jack can be installed perfectly plumb.

5. Protect cylinder of the jack unit with a sealed pressurized PVC Schedule 80 liner with monitoring capability.

6. Provide double casing for each elevator, as shown on the Contract Drawings.

7. The cylinder well, including the casing(s) shall be sunk into the ground. Well hole is to be provided by the Elevator Contractor.

8. Prior to the installation of the drill casing, the contractor shall submit a drawing showing the details of installation of hydraulic jack unit inside the drill casing for approval. The drawing shall show all dimensions of the pressurized hydraulic jack, a PVC liner capable of being pressurized to monitor and fluid leakage shall encase the jack.

23. New Elevator Controller Components:

1. An Allen Bradley Control Logix, Compact Logix or approved equal, PLC controller that supports DF1 communication over Ethernet/TCP/IP shall be designed to accomplish the type of elevator operation as indicated herein. Controller shall govern starting, stopping and direction of travel of the elevator.

2. Time source synchronization shall be provided with new standard New Jersey Transit time sources using either SNTP or NTP protocols. Configuration of the time synchronization agent shall be developed under the direction of NJ Transit IS Staff.
3. Controller shall protect the motor against current overload, phase reversal, and phase failure. A reverse phase relay shall be provided on the controller. Controller shall automatically open the power supply, and bring the car to rest if any of the safety devices fail to operate or if the power fails.

1. Selective Collective Operation: As defined by ASME A17.1.

2. New selector device to be provided.

4. Controller to include programmable automatic dispatching system to enter a call to the opposite terminal landing upon entry of a patron into the elevator cab. Automatic dispatching shall be initiated based on registration of a hall call at an elevator landing. Control system will automatically enter a car call for the opposite terminal landing to the landing where the hall call is registered when the infrared light ray screen door edge protector detects passage of a patron through the door. Registration of the automatic car call shall be reflected on the car call station but illumination of the indicator lamp as done for normal car call entries. System shall be programmable to have the automatic dispatch feature on or off and shall be controllable remotely through the PLC interface to the New Jersey Transit Remote Control and Monitoring System.

5. Controller shall be provided with starting switches of adequate size, together with all relays and switches to accomplish the type of elevator operation indicated herein. Switches that operate power circuits shall be designed to prevent sticking due to fusing. Overload relay shall be of the manual reset type of suitable size for the motor furnished.

6. All controller components shall be neatly mounted and wired in a NEMA 4X stainless steel enclosure supplied with an approved venting kit. Venting kit shall be Ice Qube model 1Q150 FPW Washdown Filter Fan Type with a NEMA 4X rating, or approved equal. All terminals and wires shall have identification markings. For wall mounted enclosures, these types of controllers are to be affixed to walls utilizing unistrut of sufficient strength and size capable of sustaining overall controller enclosure with components weight. For controller enclosures that are floor mounted and freestanding, these types of enclosures are to be supplied with a 6" high base to prevent potential water infiltration.
7. Provide a separate battery powered unit that senses loss of power. Two (2) Batteries shall be 12 volt minimum, sealed nickel cadmium or gel cell construction. When loss of power occurs, elevator shall descend to lowest landing and open doors automatically. After a predetermined time, the doors shall close and the elevator shall remain inoperative until normal power is restored. The door open and alarm button shall operate under battery power. Reduced speed for evacuation on battery operation is permitted.

8. The PLC shall communicate directly with the Human Machine Interface (HMI) Software portion of the New Jersey Transit Remote Control and Monitoring System via standard Ethernet LAN connection through SCADA protocols.

9. The diagnostic system shall be an integral part of the controller and provide user-friendly interaction between the service person and the controller system.

10. A BNC connector (stud/pass thru) shall be mounted in the controller and shall be used for the CCTV coaxial cable. Terminal blocks for CCTV power cables shall also be mounted in the controller. These connections shall be kept away from high voltage. Additional noise suppression devices may be required to filter video signal. BNC connector (stud/pass thru) will act as a junction for the video coax cable.

11. PLC will be used for remote monitoring and control capabilities. The installer's engineering department will be responsible for programming the PLC and coordinating with the New Jersey Transit Remote Control and Monitoring System.

12. The PLC rack shall provide space for the following Signal List and for two (2) future single slot modules. Unused (or inapplicable) registers shall be included in the PLC logic and data tag tables to maintain conformity of system wide NJT data registers. Contractor shall provide a full summary of data registers and addresses to the Authority.
<table>
<thead>
<tr>
<th>Signal Description</th>
<th>Registers</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Signal Power Supply Good</td>
<td>1</td>
<td>24-volt supply for inputs is on</td>
</tr>
<tr>
<td>2. Safety Circuit Good</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3. Top Final Limit Tripped</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4. Bottom Final Limit Tripped</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5. Inspection Operation On</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6. Independent Service On</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>7. Fire Service Phase 1 On</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>8. Fire Service Phase 2 On</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>9. Smoke Sensor @ Main On</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>10. Smoke Sensor @ Others On</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>11. Override On</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>12. Car is running UP</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>13. Car is running DN</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>14. Car is in Door Zone</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>15. Interlocks are made</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>16. Front Door Gate Switch Made</td>
<td>16</td>
<td>no signal wire if no rear door</td>
</tr>
<tr>
<td>17. Rear Door Gate Switch Made</td>
<td>17</td>
<td>no signal wire if no rear door</td>
</tr>
<tr>
<td>18. Front Door Fully Closed</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>19. Front Door Fully Open</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>20. Front Door RevActivated</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>21. Rear Door Fully Closed</td>
<td>21</td>
<td>no signal wire if no rear door</td>
</tr>
<tr>
<td>22. Rear Door Fully Closed</td>
<td>22</td>
<td>no signal wire if no rear door</td>
</tr>
<tr>
<td>23. Rear Door Reversal Activated</td>
<td>23</td>
<td>no signal wire if no rear door</td>
</tr>
<tr>
<td>24. Brake Lifted</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>25. Drive Ready / Fault</td>
<td>25</td>
<td>no signal wire if no drive</td>
</tr>
<tr>
<td>26. Car Position 1 (Bit 1)</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>27. Car Position 2 (Bit 2)</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>28. Car Position 3 (Bit 4)</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>29. Car Position 4 (Bit 8)</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>30. Car Position 5 (Bit 16)</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>31. Loss of DVR signal</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>32. Telephone line voltage</td>
<td>32</td>
<td>Voltage deviation (+-) 10 %</td>
</tr>
<tr>
<td>33. Pressure Switch ON</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>34. Stop Switch ON</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>35. PLC Backplane comm. fault</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>36. Processor reset</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>37. Low Oil</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>38. Power Off</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>39. Electrical Protective Devices</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>40. Emergency Alarm Bell On</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>41. Travel Time</td>
<td>41</td>
<td></td>
</tr>
</tbody>
</table>
13. The elevator controller shall be configured to receive and process remote operational control calls through the network connection. Response and processing of remote elevator control calls shall be defeated during Fire Service operation and the elevator shall operate totally under the fireman’s control. Remote operational control provisions shall be coordinated with New Jersey Transit Remote Control and Monitoring System and shall include, but are not limited to, the following:
   a. Remote Lockout of Elevator preventing operation
   b. Remote Door Open Call registration
   c. Remote Door Close Call Registration
   d. Remote Car Call Destination registration
   e. Remote Hall Call registration, each landing
   f. Remote Emergency Call Access

14. The elevator controller shall include contacts integrating the station\system PA announcements for broadcast over the elevator cab speaker system.

15. The PLC shall store the last 99 faults, accessible via laptop connection, panel view and remote communications.

16. OEM’s may not supply their standard elevator controller for this project.

17. An alpha numeric fault indicator shall be provided in the service cabinet.

18. In cases where the programming is done by the supplier, the supplier shall provide a copy of all working programs in electronic format as well as a printed program listing.

19. Each I/O shall be fuse protected or utilize optical isolation.

20. Provide UPS for PLC memory.
21. The ability to monitor the status of any processor remotely via the network.

22. The ability to communicate with all other models of programmable controller manufactured by said manufacturer.

23. The Programmable Controller shall have one dedicated serial port which supports RS-232-C signals. It shall be accessible in ladder logic and provide support for Point to Point and Slave communication protocol systems. Alternatively, it must be usable for programming purposes or for access to remote programmers via modems.

24. The Programmable Controller shall have one dedicated serial port which supports RS-485 signals. It shall be accessible in ladder logic and provide support for DH485 protocol systems. It must be usable for programming purposes.

25. Bi-directional communication between the programmable controllers and the communication network via a standard modem interface. The protocols shall meet EIA RS-232-C electrical standards and ANSI standard communication protocols.

26. The processor shall have built-in diagnostics and self-test, such that each time power is cycled, the processor does a complete CPU and RAM memory test. Additionally the power-up test will momentarily light up all diagnostic LED’s to be sure they are working. A power up test will not be performed if the internal flag (bit) for Fireman’s Service Phase I is latched. The processor shall be capable of reporting major and minor fault codes and processor status information back to the polling master, provided the fault is not a catastrophic hardware failure where the processor is unable to power up.

27. The processor shall have a built-in watchdog timer to ensure that all processor program scans occur within the time limit set by the watchdog timer. The watchdog timer cycle shall be adjustable from 20 msec to 2.5 seconds in 10 msec increments.

28. The processor shall have individual LED indicators that are clearly visible and labeled for easy identification. At a minimum the following indicators must be provided:
1. CPU is in RUN mode
2. CPU is FAULTED
3. CPU battery is LOW
4. I/O points are FORCED and are not under program control
5. COMMUNICATION channels are active.

29. Input/Output Modules

1. The Input/Output Modules shall be slot type and compatible with the PLC processor I/O structure. Each module shall be provided with a wiring arm to connect panel wiring to the module.

2. Discrete Input Modules: 24 VDC, 16 point input module suitable for use with input devices. Provide Allen-Bradley Model 1746-IB16 or approved equal.

3. Discrete Output Modules: 24 VDC, 16 point output module for use with 24 VDC output relays. Provide Allen-Bradley Model 1746-OB16 or approved equal.

4. Analog Input Modules: Converts 8 differential analog signals to proportional twelve-bit binary values. The module shall accept 4 – 20 Ma signals. Provide Allen-Bradley Module 1746-NI8 or approved equal.

5. Analog Output Modules: Converts 12-bit binary values to four analog output signals. The module shall output a 4 – 20 ma DC signal. Provide Allen-Bradley 1746-N18 or approved equal.

6. Device Net network card. The PLC shall have a Device Net network card Allen-Bradley part number 1747-SDN or approved equal.

30. I/O Chassis and Power Supply:

1. The I/O Chassis shall be a minimum 7-slot chassis. The chassis shall accept PLC slot type modules to provide backplane connections. The first slot shall accept the processor. Provide Allen-Bradley 1746-A7 or approved equal.
2. Power supplies shall provide power to the PLC processors, I/O rack and I/O modules. The power supply shall be suitable for operation of 120 VAC, single phase power. Power supply capacity shall be a minimum of 150% of the connected load. Provide Allen-Bradley 1746-P2 or 1746-P4 or approved equal as required by the application.

31. The controller shall be designed to operate automatically on standby power.

32. Dielectric Matting: Dielectric rubber matting to be supplied on floor in front of controller to prevent accidental shock.

33. Door Protective device: An infrared curtain detection device manufactured by Formula systems or approved equal, which will cause both car and hoistway doors to reverse, should it detect an obstruction in the elevator entrance. Device housing shall be NEMA 4X or IP56 rated for external location.

24. Hoistway Entrances:

1. General:

   1. Hoistway entrances shall be of the horizontal sliding type, with operation and number of panels as indicated on the Contract Drawings.

   2. Door panels shall be stainless steel type 316L throughout or as shown on the Contract Drawings.

   3. Fascia Plate and Dust Covers: Fascia plate and dust covers shall be a # 14 gauge stainless steel type 316L or as shown on the contract drawings, reinforced as necessary to ensure compliance with ASME section 2.11.10.1.2. Fascia plate shall extend at least the full width of the door opening and extend down from the sill at least the length of the leveling zone plus three inches. Dust cover shall extend full width of door travel and fastened to hanger support at the highest
landing. Toe guard shall be fastened to the sill at the lowest landing. Fascia plates, dust covers, and Toe guard shall be stainless steel type 316L or as shown on the Contract Drawings.

2. Hoistway Frames and Doors:

1. Hoistway frames shall be as shown on the Contract Drawings.

2. Hoistway doors shall be as shown on the Contract Drawings. Hoistway doors shall be reinforced and provided with keyways as required for operating mechanisms and door hangers. Each door panel shall have two (2) laminated phenolic bottom guides that run in landing sill slots. Guides shall be replaceable without removing door panels. Additionally each door panel shall have a Stainless Steel Door Safety Retainer to prevent displacement of door panels if the primary means fail. The retaining means shall not be subjected to wear or stress during normal door operation or maintenance.

3. Door Hangers: Door hangers for hoistway doors shall be of the two point suspension sheave type equipped with grease packed heavy duty precision ball bearings, eccentric up-thrust rollers, and oiler/cleaners. Track shall be of formed cold rolled steel or cold drawn steel with rounded track surface to receive sheaves. Track shall be mounted on an eccentric stud to provide for adjustment. Landing door tracks, closers, interlocks, hanger rollers, and related equipment shall be galvanized or zinc plated.

4. Provide die cast jamb markings (2 per entrance) mounted at 5'-0"

5. Hoistway Floor Numbering: Provide floor numbering labels or decals to the hoistway side of the enclosure or hoistway doors. Minimum size shall be four (4) inches.

3. Struts and Closer Support Angles: Hoistway entrances adjacent to non-load bearing walls (gypsum dry wall, gypsum block, etc.) shall have hanger housing and door closers supported by stainless steel angles of adequate size. Angles shall be continuous between sill
and building beams above and shall be bolted to the hanger support. For load bearing walls (masonry, concrete block), submit for Engineer's approval, shop drawings of the method to be used to support hanger housing and door closers on the wall.

4. Landing Sills and Guards: Landing sills shall conform to the Code and shall be type 316 stainless steel polished finish, with grooves for door guides machine planed for minimum clearance. Mount sills on steel supports anchored to floor construction. Landing sills shall be guarded in accordance with the Code by landing sill guards of 14 gauge steel minimum.

5. Hanger Supports and Cover Plates: Hanger supports shall be 3/16 inch thick stainless steel bolted to stainless steel strut angles and closer support angles. Hanger cover plates shall be of 14 gauge stainless steel minimum and shall extend the full travel of the doors. Covers shall be made in sections for convenient access when servicing hangers. Hanger sections above door openings shall be removable from within elevator car.

6. Transoms: If required, by the contract drawings transoms shall be included.

7. Interlocks and Contacts: All hoistway door equipment shall be zinc plated NEMA 4 as supplied by G.A.L. or approved equal

   1. The doors at each hoistway entrance shall be equipped with approved hoistway door interlocks of the hoistway unit system type tested as required by the Code.

   2. Interlock shall prevent operation of the car away from a landing until doors are locked in the closed position. Interlock shall prevent doors from opening at any landing from the corridor side unless car is at rest at that landing, or is in the leveling zone and stopping at that landing.

   3. Hoistway door unlocking devices shall conform to the requirements of the Code and shall be provided to permit authorized persons to gain access to hoistway when car is away from landing.
4. Provide an electric contact mounted on the car that will prevent the car from moving away from landing unless car doors are closed.

8. Hoistway Door Closers: Provide sill mounted hoistway door closers for each set of hoistway doors. Each set of hall doors are to be self closing and locking.

9. Landing Sill Heating: Provide each hoistway sill with a heat trace.
   1. Heat trace to run entire length of each sill.
   2. Heat trace system shall be low voltage

10. Hanger Supports and Cover Plates: Hanger supports shall be 3/16 inch thick stainless steel bolted to stainless steel strut angles and closer support angles. Hanger cover plates shall be of 14 gauge steel minimum and shall extend the full travel of the doors. Covers shall be made in sections for convenient access when servicing hangers. Hanger sections above door openings shall be removable from within elevator car.

25. Elevator Car:
   1. General:
      1. Elevator car and car components shall meet the applicable requirements of the Code. Car control station and position indicator shall be as specified herein.
      2. Entire car assembly, including car frame and platform, shall be free from warps, buckles, and squeaks and rattles. Joints shall be lightproof. Rail brackets, pit work, buffer stands and buffer supports shall be hot dipped galvanized.
   2. Car Frame and Platform:
      1. Car frame and platform shall be stainless or hot dipped galvanized welded steel units designed and fabricated in accordance with applicable requirements herein and the Code.
2. Protect car platform with fire retardant material and shall be equipped with ¾ inch marine grade plywood sub flooring and Stainless Steel with polished finish thresholds. The platform shall be recessed as required for flooring or as shown on the contract drawings.

3. Seamless and resilient elevator cab flooring shall be poured or laid in accordance with manufacturer’s instructions over a minimum of one 3/4” thick marine grade tongue in groove plywood substrate.

4. A stainless steel type 316L toe guard not less than 1.5 mm in thickness and 48” in length shall extend the full width of the door opening. It shall be properly supported and braced to the car platform to meet code. The lower portion of the guard shall be bent back at an angle of not less than 60 deg. nor more than 75 deg. from the horizontal.

3. Elevator Car Guides: Car guides shall be of the roller type; each guide shall consist of a set of three (3) large diameter polyurethane rollers equipped with sealed preloaded ball bearings. Each roller shall be supported by a pivoted rocker arm that shall automatically adjust itself to guide rail misalignment and prevent excessive lateral car movement.

4. Car Enclosures:
   1. Elevator cabs shall be provided as detailed on the Contract Drawings.
   2. Car Top: Car top shall be of stretcher leveled, cabinet grade, and 12-gauge furniture sheet steel, reinforced to support 200 lbs. on any one square foot area. An emergency exit shall be installed in the car top in conformance with the Code. Interior surface of car top shall be as shown on the Contract Drawings.
   3. Interior Walls: Interior walls shall be as shown on the Contract Drawings.
   4. Exterior Wall: Exterior walls shall be as shown on the Contract Drawings.
5. Protection Pads: A One (1) complete set of Protection Pads for all four (4) walls of the cab are to be supplied. All Pads are to be hung from hooks as approved by the engineer. Make all necessary cut-outs in the pads for all equipments located within the Elevator.

6. Car Doors: Car doors shall be of the horizontal sliding type with required number of panels. Door material shall be stainless steel #316L throughout, or as shown on the Contract Drawings. Doors shall protect the full width and height of car entrance opening when in the fully closed position. Car doorframe shall be integral with front wall of cab.

7. Glass Panels: All glass panels shall be fixed in a permanent position. All panels shall be removable from the interior of the cab. Glass shall be mounted with tamper resistant hardware. Cleaning instructions shall be provided by the elevator vendor to NJT at the end of the project.

5. Car Door Equipment:

1. Door Hangers: Door hangers for car doors shall be of the two point suspension sheave type equipped with grease packed heavy duty precision ball bearings, eccentric up-thrust rollers, and oiler/cleaners. Track shall be of formed cold rolled steel or cold drawn steel with rounded track surface to receive sheaves. Track shall be mounted on an eccentric stud to provide for adjustment. Landing door tracks, closers, interlocks, hanger rollers, and related equipment shall be galvanized or zinc plated.

2. Car Door Operators: Provide a GAL MOVFR closed loop door operator of weather resistant NEMA 4 design or approved equal. Door Operators shall be designed to operate car and hoistway doors simultaneously at the speed specified. Doors shall open automatically when stop at a landing to pickup or discharge passengers, and close automatically after predetermined time interval has elapsed. The doors shall be capable of smooth and quiet operation without slam or shock at each landing.
3. Non-Contact Door Reopening Devices: Provide an infra-red light emitting diode car door reopening devices. Unit must have a minimum of 88 LED beams. If door movement is obstructed, the doors shall immediately reopen. Mechanical reopening device is not acceptable.

4. Each door panel shall have two (2) laminated phenolic bottom guides that run in landing sill slots. Guides shall be replaceable without removing door panels. Additionally each door panel shall have a stainless steel door safety retainer to prevent displacement of door panels if the primary means fail. The retaining means shall not be subjected to wear or stress during normal door operation or maintenance.

5. Provide approved electronic cab door interlocking device. Electrodyne or approved equal.

6. Appurtenances:
   
   1. Exhaust Fan: Exhaust fan, mounted on the car top, shall be a two speed, squirrel cage, centrifugal blower type capable of exhausting at least 350/700 CFM and shall conform to the requirements of the Code. Fan housing shall be NEMA 4 rated. There shall be a minimum air handling capacity to provide one air change per minute based on net inside car volume. An auxiliary power source capable of providing the minimum air handling capacity for a continuous period of at least one (1) hour shall be provided on each elevator car. Manufacturer shall be Morrison Products, or approved equal. The system shall be capable of providing power for both emergency fan and lamp.
   
   2. Car lighting shall provide a minimum of 10-foot candles, measured at the sill with the doors closed, and as shown on the Contract Drawings. Car lighting shall be provided with emergency battery backup upon failure or interruption of normal car lighting. Emergency lighting unit shall provide required lighting for a minimum of four (4) hours. Battery charger shall be capable of restoring battery to full charge within sixteen (16) hours after resumption of normal power. Provide in the car an external means for testing battery, lamps, and alarm bell.
3. Handrails: Stainless steel handrails with finish to match faceplates of signal and control fixtures shall be provided as shown on the Contract Drawings.

4. Car Top Safety Handrails: Handrails shall be provided as shown on the Contract Drawings. Handrails shall meet all code requirements.

5. Emergency Car Lighting and Alarm Bell Power Supply System:

Provide an emergency car lighting and alarm bell power system manufactured by EPCO, Flexilite system EFP, or approved equal. Emergency lighting shall be provided by the two normal car lighting fixtures and provide illumination of at least five (5) foot-candles at a point four (4) feet above the floor, one foot in front of the car station. The system shall have a testing circuit wired to a key-operated test switch located in the Car Operation Panel. Upon interruption of normal power, the car lights shall automatically illuminate within ten (10) seconds and permit operation of the alarm bell, subject to the activation of the emergency alarm button. The power pack shall be capable of providing minimum of one (1) hour continuous alarm operation and four (4) hours of continuous illumination. The power supply system shall be providing emergency power for both emergency lamp and ventilation fan.

6. Leveling system: Each elevator shall be equipped with a NEMA 4X rated automatic leveling device which will align the car within 1/8” of the level of any floor when stopped. Use of optical sensors in leveling system shall be prohibited.

26. Signal Fixtures and Control Devices:

1. General: Provide signal fixtures and control devices for each elevator. Buttons and signals shall be tamper resistant of the LED illuminated type that light-up when activated and remain lit until call or other function has been fulfilled. All signal fixture and control device faceplates shall be of Type 316 L, 10 gauge stainless steel with AISC No. 4 finish, unless otherwise shown on the Contract.
Drawings. All hall and car operating panel fixtures shall be Nema 4X with rolled edge backboxes and gasketed neoprene covers. All cutting and patching of exterior walls shall be accomplished by others, after elevator vendor sets backboxes in place.

2. Car Operating Station:

1. Car operating station shall contain a numbered and labeled call button for each landing served as per the facilities needs, and buttons for DOOR-OPEN, DOOR-CLOSE, and ALARM call functions. Buttons shall be tamper resistant stainless steel. STOP key switch (one per car operating station) as required per code. Car operating station to be equipped with keys and locks as approved by the engineer.

2. Car operating panel shall provide a service cabinet. Station shall have keyed switches for car light, exhaust fan, inspection, independent operation, and a 120v ac GFCI outlet.

3. Panel provide a fire service cabinet. Station shall have fire door open, close, reset buttons, fire signals. Panel door is to be open with the local fire service key. Panel shall be hinged and secured with tamperproof screws.

4. Provide raised markings for the car buttons and car controls in compliance with the "Handicapped Requirements" of ANSI/ASME A17.1.

5. Provide a top-of-car operating device in compliance the Code. The device shall have control switches for UP, DOWN, SAFETY, OPERATE/INSPECT and EMERGENCY STOP. The device shall also have a GFCI 110v ac outlet for extension cord and an 110v ac work light with switch and required fire service indication. Box shall be NEMA 4X.

3. Emergency Communication Device:

1. Emergency communication device shall be hands free phone and Code compliant.
4. Hall Stations: Hall stations of the push-button, call acknowledging, type 316 stainless steel, NEMA 4X with rolled edged gasketed neoprene covers, tamper resistant type shall be recess mounted into the wall at all elevator landings. Highest landing shall have a single DOWN button. Lowest landing shall have a single UP button. Intermediate landings shall have UP and DOWN buttons with the Up button on top. Faceplate finish shall be stainless steel with AISC No. 4 finish, unless otherwise shown on the Contract Drawings.

5. Fireman Return Phase 1 Key switch: Main and/or Auxiliary Keys Switches shall be incorporated into the appropriate Hall Button Fixture.

6. Car Position Indicator: Car position indicator shall be tamper resistant of the illuminated-signal or digital-display type, complete with an adjustable electronic chime that shall sound when car is passing a floor served by the elevator. Include direction-of-next travel signal if not provided in car control station. Indicator shall be mounted in the operating station, or as indicated on the contract drawings. NEMA 4 with rolled edge gasketed covers.

7. Hall Lanterns:
   1. Tamper resistant car lanterns shall be equipped with illuminated UP and DOWN signal arrows, but provide single arrow where only one direction is possible. Provide units projecting from faceplate for ease of angular viewing. Match materials, finishes and mounting method with car stations. NEMA 4 with rolled edge gasketed covers.
   2. In conjunction with each Hall lantern, provide an adjustable electronic chime signal to indicate that a car is arriving in response to a hall call and to indicate direction of car travel. Signal shall sound one for up direction of travel and twice for down direction.
   3. One Hall lantern per opening shall be furnished and installed by elevator contractor.

8. Bell Alarm System: Bell alarm system for elevator shall be properly located within building and audible outside hoistway when activated by the ALARM call button on car control station.
9. Firefighters' Service System: Firefighters' service system for the elevator shall be provided in compliance with the applicable Code. Utilize YALE key 3502 for fire service.

10. Provisions shall be provided in the controller and in the signal fixtures to accommodate an emergency generator to operate the elevator in case of loss of normal power. Such features and equipment will meet all ASME A 17.1 code requirements.

11. Provide emergency communication monitoring capability in the main floor hall fixture, along with code required jewel and buzzer.

2.5 PIPING AND APPURtenances

1. Pipe and Fittings: Provide piping sizes recommended by elevator manufacturer with isolation couplings to prevent sound/vibration transmissions from power unit. Hydraulic oil piping shall be ASTM A53, standard weight Schedule 80 pipe with extra heavy malleable iron, 300 WSP fittings. Victaulic fittings are not permitted.

2. Oil lines shall be supported by approved brackets not over 8 feet on centers and at least two separate means of support between fittings.

3. Provide thematically controlled heat tape for the oil piping between the motor room pump to the jack. Heat tape shall operate if the outside temperature is below 32 (f) degrees.

4. Provide one (1) inch thick oil piping insulation jacket between the motor room pump to the jack unit located in the elevator pit.

5. Provide sleeving where oil piping passes through a wall. The sleeving shall be one (1) inch larger than the pipe diameter that will pass through the wall opening. Insulate the hole after installation of oil piping has been completed.

6. Muffler: Provide a blow-out-proof muffler in the oil line between the hydraulic power unit and jack assembly. Muffler shall reduce pulsation and noise originating from power unit. Muffler shall be easily accessible for inspection of interior parts without removing the housing from the oil line.

7. Mainline Strainer: Provide a self-cleaning "Y" Type strainer in the oil line near the power unit. The strainer shall be made of ductile iron.
working pressure shall be 640 psi at 650°Fahrenheit and be Muesso # 251-D1 or approved equal. The strainer shall be equipped with a 40 mesh stainless steel screen. Strainer shall be sufficiently sized for low-pressure drop.

8. Ball Valves:
   1. Ball valves shall be rated at 1000 psi, WOG, cold non-shock. They shall be made of carbon steel and have RPTFE seats and seals and be Model 89-100, as manufactured by Apollo, or approved equal.
   2. Ball valves shall be provided on the hydraulic oil line in the machine room at the power unit outlet and in the pit at the jack inlet.

9. Safety Valve:
   1. A safety valve shall be provided to retard the downward motion of the elevator so as to bring it to a gradual stop in case of a mainline separation or other non-cylinder related overspeed condition.
   2. The valve shall have a fully adjustable flow rate and be set to actuate at a flow rate which is 125% of the flow rate required to produce the operating speed in the down direction. The valve shall also have an adjustable closing rate and allow manual lowering around the valve when set. Valve shall either have a built in pressure valve with manual shut off or an adaptor to fit a gauge for testing.

10. Heat tracing and insulation:
   1. Provide heat tracing and insulation to exposed oil lines.

2.6 ELECTRICAL INSTALLATION

1. General:
   1. Furnish and install wiring and conduit in the hoistways, machine rooms and pits, including traveling cables adequate for the proper operation of the equipment. Provide wire and conduit from the disconnect switches to all controllers and between all new equipment. Electrical installation shall be in accordance with all National and Local Electrical Codes.
2. All connections to terminal blocks shall be made with either terminal eyelet connections or pressure wire connectors of the clamp type that meet UL 486 requirements for stranded wire. Terminal blocks shall have permanent indelible identifying numbers for each connection.

3. All conduits and traveling cables shall have a minimum of 10% spare wires, but never less than two spare wires of each type of wire in the conduit or cable plus two (2) spare CCTV wires per Traveling Cable. This includes conduits between all control equipment, hoistway and car terminal junction boxes and signal fixtures.

4. All wiring shall be terminated and tagged at their terminals, including spare circuits. The tag identification, the terminal identification, and approved wiring diagram identifications shall match.

2. Conduit:

1. Unless otherwise specified, all electrical conductors in pits and hoistways, except traveling cable connection to the car shall be provided in threaded rigid steel conduit NEMA 4X with steel outlet boxes to match, except that a small amount of watertight flexible conduit may be used. All boxes and fixtures shall be NEMA4X unless otherwise noted.

2. Rigid steel conduit shall be full weight, threaded, hot-dip galvanized, inside enameled, conforming to ANSI C80.1.

3. Conduit fittings and bodies shall meet ANSI/NEMA 4X; threaded mallable type, material to match conduit.

4. Terminal boxes, pull boxes and other similar items shall be of approved construction, thoroughly reinforced, and shall meet ANSI/NEMA 4X.

5. All electrical boxes exceeding 150 cubic inches shall be supported independently of the conduits.

6. All raceways shall be threaded rigid steel conduit complying with ANSI/NEMA 4X.
7. Where permitted flexible heavy-duty service cord, type SO, may be used between fixed car wiring and switches on car doors for safety edges and light ray devices for reversal devices.

8. Where permitted, flexible metal conduit shall be fabricated in continuous length from galvanized steel strip, spirally wound and formed to provide an interlocking design with a gray XLPO Thermoset Type 2 outerjacket.

9. All conduits terminating in steel cabinets, junction boxes, wireways, switch boxes, outlet boxes and similar locations shall have approved insulation bushings. If the bushings are constructed completely of insulation material, a steel locknut shall be installed under the bushing. At ends of conduits not terminating in steel cabinets or boxes, the conductors shall be protected by terminal fittings having an insulated opening for the conductors.

10. All conduits terminating in NEMA 4X boxes shall be backed up with flat rust resistant steel plates to fit the entire area where the conduit penetrated the box.

11. All conduit fittings and connections shall be threaded type. The use of set screw or indentations, or compression fittings as a means of attachment is not permitted.

12. Connect motors and other components subject to movement or vibration, to the conduit systems with flexible conduit.

13. The Contractor shall furnish all materials and completely wire all parts of the electrical equipment of the elevators including electrical devices on hatch doors. All car wiring and conduit shall be replaced with new including car junction boxes.

14. All solid state and electrical components located on top of the car enclosure or in the hoistway shall be installed within NEMA 4X enclosures.

15. Conduits shall be brought and connected to suitable approved connection boxes at all outlets, apparatus and panels.

16. Conduit Sizing, Arrangement, and Support
1. Size conduit per NEC for conductor type installed or for Type THW conductors, whichever is larger; 3/4-inch minimum size for conduit.

2. Conduits for small devices such as door switches, interlocks, etc. shall be permitted at ½ inch.

3. The total overall cross sectional area of the wires contained in any conduit shall not exceed 40 percent of the internal area of the conduit.

4. Arrange conduit to maintain headroom and present a neat appearance.

5. Route exposed conduit parallel and perpendicular to walls and adjacent piping.

6. Maintain minimum 6-inch clearance between conduit and piping. Maintain 12-inch clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.

7. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized straps, lay-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers.

8. Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit on racks.

9. Do not fasten conduit with wire or perforated pipe straps. Remove all wire used for temporary conduit support during construction, before conductors are pulled.

10. No conduit shall be attached to a cable tray or installed within 6 inches of a cable tray or light fitting except for termination.

11. Approved strain boxes shall be installed for all vertical runs in accordance with Code.
17. Where conduit penetrates fire-rated walls and floors, seal opening around conduit with UL listed through penetration fire stop system to maintain wall or floor rating.

18. All interlock, hall button and limit switch branch wiring shall be enclosed in flexible steel conduit with covering of liquid tight Type "XLPO" with connectors having nylon insulated throat.

19. All screws used for terminal connections of all wiring (machine room, hoistway and pit) shall be provided with "star washers" of proper size and type.

20. All existing conduit and wiring shall be removed and wall/floor slabs patched with fire rated material.

3. **Conductors:**

   1. Unless otherwise specified, conductors, exclusive of traveling cables, shall be 98% conductivity copper, solid, for size 10 AWG and smaller, and stranded for size 8 AWG and larger shall be stranded or solid coated annealed copper in accordance with the NEC for Type THHW.

   2. Where 16 and 18 AWG are permitted by Code, either single conductor cable in accordance with Code for Type TF, or multiple conductor cable may be used provided the insulation of single conductor cable and outer jacket of multiple conductor cable is flame retardant and moisture resistant.

   3. **Insulation Voltage Rating:** 600 volts.

   4. **Insulation:** ANSI/NFPA 70, type THHN/THWN, XHHW or THW.

   5. The use of PVC insulation shall not be permitted.

   6. **Color Coding:** All power conductors identified as to phase and voltage by means of color impregnated insulation, as follows:

   7. Voltage ØA ØB ØC Neutral Ground

8. 120/208V Black Red Blue White Green
9. 277/480V Brown Orange Yellow White Green

10. For wire sizes No. 8 AWG and larger, color banding tape, minimum 2 inches wide, may be used at all accessible locations in lieu of colored insulation.

11. Multiple conductor cable shall have color coding or other suitable identification for each conductor. Conductors for control boards shall be in accordance with Code.

12. No joints or splices shall be permitted in wiring except at outlets.

13. All wiring shall test free from short circuits or grounds. Insulation resistance between individual external conductors and between conductors and ground shall be not less than one meg-ohm.

14. Where size of conductors is not given, capacity shall be such that maximum current shall not exceed limits prescribed by Code.

15. Equipment grounding shall be furnished and installed. Ground conduits, supports, controller enclosures, motors, platform and car frames, and all other non-current conducting metal enclosures for electrical equipment in accordance with Code. The ground wires shall be copper, green, insulated and sized as required.

16. Terminal connections for all conductors used for external wiring between various items of elevator equipment shall be solderless pressure wire connectors in accordance with Code. The Contractor may at his option make these terminal connections on No. 10 or smaller conductors with approved terminal eyelets set on the conductor with a special setting tool, or with an approved pressure type terminal block. Terminal blocks using pierce-through serrated washers are not acceptable.

17. Provide all necessary conduit and wiring between all remote machine room and hoistway.

4. Traveling Cable and Car Wiring:

1. Provide traveling cables from terminal junction boxes on the hoistway wall approximately four (4) feet above the midpoint of the elevator shaft to the terminal junction boxes on the top of the elevator car.
2. Provide 10 percent but not less than 2 spare conductors of each size wire in each traveling cable.

3. The power circuit wiring sizing shall comply with the requirements of the Code. Provide separate power wires for each of the following items: car fan, car lights, car receptacles, car door operator.

4. Spare wiring: Additional spare cable/wire shall be provided from the car top to the machine room elevator controller. Two (2) spare coaxial cables shielded for the CCTV system and four (4) twisted shielded pairs for security and telephone systems.

5. Pre-hang the traveling cables for at least 24 hours, with the end suitably weighted, to eliminate twisting during operation.

6. Terminal junction boxes shall be equipped with sufficient terminal, so that all wires, including spares, are terminated. Terminals shall be identified with indelible markings and all wires shall be tagged.

2.7 OPERATION

1. General: Operation shall be collective

1. Collective Operation

2. Car Stall Protective Circuit: Provide a protective circuit which shall stop the motor and the pump and return the car to its lowest floor landing in the event that the car, while traveling up, does not reach its designated landing within a predetermined time interval. This circuit shall permit a normal exit from the car but prevent further operation of the elevator until the problem has been corrected.

3. Low Oil Protective Device: A low oil protective control circuit shall be provided to automatically stop the car should oil level become insufficient to permit car respond to an upper floor call. System shall automatically bring car down to lowest landing, open doors, and then shut down elevator.

4. Automatic Leveling: Hydraulic power unit design shall be coordinated with the control so that car shall slow down and stop automatically at the floor after transition from contract speed. Car level shall be maintained automatically within one-quarter inch of the landing by an anti-creep
leveling device regardless of any deviation that may be caused by the loading or unloading of the car. Landing zone detection shall indicate to the control system the position with respect to the floor level.

5. Top-of-Car Operating Device: Operation of elevator from top-of-car device shall also be subject to applicable electrical protective devices required in the Code.

6. Access / Inspection Operation: Activating either of these operations shall make car and hall buttons inoperative. The enabling key switch in the car-operating panel shall permit inspection operation from within the elevator or from a switches located at the top and bottom landings to lower or raise the elevator away from the floor with the hoistway door open. This will allow access to the top of the elevator for inspection purposes.

7. Contractor shall provide technical support for the installation and operation of the complete elevator in accordance with the manufacturer’s instruction and approved shop drawings.

8. Battery Standby Power Transfer: Upon the loss of normal power provide controls to automatically lower the elevator(s) nonstop to the lowest landing. When arriving at the lowest landing, the elevator doors shall open automatically and remain open until regular door time has expired. The elevator shall then become deactivated. The control panel for the automatic lowering device shall be located in the elevator controller and powered from the elevator feeders. The panel shall include two (2) gel batteries, solid-state controls, charger, monitor lights and a test button. Battery to be rechargeable with a 10-year life expectancy.

9. Low Temperature Timer: Provide a controller circuit which will bring elevator to rest at lowest landing if no hall or car calls are initiated within five minutes. Provide temperature sensor and timer that will initiate the elevator to travel to the upper landing and back to the lowest landing every ten minutes when the ambient temperature is below forty five degrees Fahrenheit.

PART 3 - EXECUTION

3.1 EXAMINATION

1. Prior to commencing with the installation of elevator equipment, examine the following and verify that no irregularities exist that would affect the quality of execution of work as specified.
1. Anchor brackets.
2. Sill support. (shall be either galvanized or stainless steel).

2. Do not proceed with installation until previous work is accepted by Contractor and allows for unqualified installation of elevator. Contractor to provide a letter of acceptance on company letterhead that they have inspected these conditions and their findings of these conditions.

3.2 INSTALLATION

1. Install elevator in accordance with the manufacturer's installation procedures and approved shop drawings.

2. Provide well hole as shown on the approved shop drawings.

3. Electrical installation shall be in accordance with all National and Local Electrical Codes.

4. Verify that electrical wiring installation is in accordance with the manufacturer's submittal and in accordance with the installation requirements of other Sections of the Specifications.

5. Erect all items square, plumb, straight and accurately fitted with tight joints and intersections.

6. Coordinate all trades to ensure that the installation of the elevators is not in conflict with the work performed of other trades.

7. Isolate non-compatible, dissimilar materials from each other by providing vibration isolation, gaskets or insulating compounds.

8. Provide protective coverings for finished surfaces.

9. Upon completion, touch up and restore damaged or defaced factory finished surfaces. Touch up any marred finishes and replace as directed by the engineer or there representative.

10. Remove protective coverings and clean exposed surfaces after completion.

11. Welding shall comply with AWS D1.1. Identify field welds with welder's identification stamp.
3.3 REMOVALS

1. Contractor shall remove and properly dispose of all equipment, removed from elevator shaft. Oil shall be properly disposed of and certificated of disposal shall be available to the railroad upon request. Old jack hole shall be backfilled with sand and capped with concrete.

2. Door frames and doors shall be removed.

3. Remove car sling, platform, rails, brackets, jack, oil tank, controller, hoistway wiring, sill supports, hoistway door headers, jack casing.

3.4 FIELD TESTING

1. Acceptance Testing:

   1. General: After installation and before date approved for start of interim maintenance, inspect and test the elevator and related equipment to the Engineer’s satisfaction that operation of every part of equipment complies with applicable requirements of the Code including sound level criteria specified herein. Inspect elevator in accordance with procedures outlined in the Code and as specified herein:

      1. Make all required tests. All tests shall be made in the presence of the Engineer and the appropriate inspector.

      2. Provide test instruments, materials, other necessary facilities and all labor required for acceptance tests specified.

2. Notification Requirements:

   1. Notify the Project Manager and the Engineer a minimum of five (5) working days prior to each scheduled test.

   2. Notify and schedule the appropriate local authorities having jurisdiction with sufficient time for all inspections, testing, and re-testing.

3. Full Load Run Test: Run elevator continuously a minimum of one (1) hour with full specified rated load, during which time car shall be stopped at top and bottom landings with a minimum standing period of 10 seconds at each landing. At the conclusion of full load run
test, hold the car at the top landing with power removed for a period of one (1) hour and measure any seepage of the elevator.

4. Speed Test: Make tests before and after full load tests. Using a tachometer on guide rail, determine actual speed of car in both directions of travel, both with full-specified rated load and no load in car. Tolerances for determining if car speeds meet the specified requirements are as follows:

1. Ascending Car Speed: Not more than 5 percent above or more than 5 percent below required speed at any weight load condition.

2. Descending Car Speed: Not more than 5 percent above or more than 5 percent below required speed at any weight load condition.

5. Car Leveling Test: Determine accuracy of floor landing tests both before and after full load run tests. Minimum of 1/4 inch leveling must be maintained. Test accuracy of landing at all floors with full load and no load in car, in both directions of travel.

6. Electrical Tests: Ensure elevator wiring system is free of short circuits and accidental grounds. Test ground resistance of elevator structure, equipment, and raceways for continuity. Using megohmmeter, determine that insulation resistance of each circuit is more than one (1) megohm or higher as required by the cable manufacturer. Determine insulation resistance for motors shall be determined under actual conditions after installation.

7. Temperature Rise Test of Hydraulic Pump Motor: Perform this test during full load run test. Start test only when all parts of equipment are within 40 degrees F (5 degrees C) of ambient temperature at time of starting test. Under these conditions, temperature rise of equipment shall be not more than 140 degrees F (60 degrees C) above ambient temperature.

8. Acceptance: Elevator acceptance will be based upon elevators meeting requirements of Contract Documents and upon evidence of passing specified acceptance tests and inspections. Conduct final testing after elevator is connected to permanent power.
9. Test Reports: Within five (5) days after completion of a test, submit a test report stating type of test, test requirements, failures or problems, and name of certifying Engineer and Title. Safety device failure or defective equipment shall be identified, with description of cause and corrective action taken.

10. Failures for any reasons shall be identified with cause(s) and corrective action taken.

11. Retest Notification Requirements:
   1. Notify the Engineer ten (10) days prior to all scheduled retests.
   2. If any equipment is found to be damaged or defective, or if the performance of the elevator does not conform to the requirements of the contract specifications or the Safety Code, no approval or acceptance of elevators shall be issued until all defects have been corrected. When the repairs and adjustments have been completed and the discrepancies corrected, notify the Engineer and request a reinspection. Rejected elevators shall not be used until they have been reinspected and approved.

12. Final Certificate of inspection for operational use must be issued by the governing authority at the completion of all work specified.
   2. Any deficiencies and defects discovered during the field-testing shall be corrected, repaired, replaced and retested to the satisfaction of the Engineer.

3.5 CLEANING
   1. Immediately upon the completion and final acceptance of the elevator, thoroughly clean the entire elevator. Including the following hoistway, pit, car top, motor room, car and hoistway doors.
   2. Remove daily all debris not necessary for the elevator’s operation that could cause safety problems.
   3. Keep areas orderly and free from debris during the progress of the project.
4. Remove all loose materials and filings resulting from this work from hoistway surfaces, pits and machine room spaces, electrical boxes, and controller.

5. Keep machine room floor clean of dirt, oil and grease.

6. Motor Room Floor: Upon final acceptance of the elevator, the Contractor is to paint the motor room floor. Color to be approved by the engineer.

PART 4 – COMPENSATION

MEASUREMENT AND PAYMENT

1. MEASUREMENT: The work of this section shall not be measured

2. PAYMENT: The cost of this section shall be included in the lump sum bid item HYDRAULIC ELEVATORS

END OF SECTION
SECTION 15000

BASIC MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes general requirements for all mechanical work, including any plumbing, process piping, fire protection or HVAC systems applicable to this project. The extent of mechanical work is as indicated on the Contract drawings and individual specification sections, whether included in Division 15 – Mechanical, or incorporated by reference.

B. Schedule and stage mechanical work to follow the overall Contract phasing plans. Furnish all labor, supervision, materials, tools and equipment necessary to coordinate and install the mechanical work as indicated on Contract drawings, or herein specified.

C. Provide and install any plumbing, process piping, fire protection and HVAC systems equipment and components thereof, including, but not limited to, the following, where applicable to this project:
   1. Flexible pipe connectors and compensators, pipe loops, offsets, and swing joints.
   2. Pipe and equipment hangers and supports, equipment bases and supports, vibration isolation, anchors, cutting, patching, pass through, fire cutoff, smoke sealed and watertight sleeves, flashing, chases, and all other mechanical equipment in association therewith.
   3. Nameplates, tags, stencils, pipe painting, pipe markers, and other means of mechanical identification.
   4. Piping, equipment, and duct insulation.
   5. Pipe, pipe fittings, valves, and connections for sanitary sewer, storm water.
   6. Roof and floor drains, cleanouts, sillcocks and hose stations, backflow preventers, oil/water separators and other plumbing specialties.
   7. Sump pumps, sewage ejectors, and other plumbing equipment.
   8. Louvers.
   9. Thermostats and control systems.
   11. Hangers, anchors, cutting, patching, pass through, fire cutoff, smoke sealed and watertight sleeves, bases, chases, and all other mechanical equipment in association therewith.
   12. Temporary water, heating, cooling, and restroom facilities for construction and all trades.

D. Install, connect, test and adjust, and leave the prescribed mechanical work ready for safe and reliable operation; fit equipment and appurtenances to space provided; and make all components readily accessible and serviceable.
1.2 DRAWINGS AND SPECIFICATIONS

A. Drawings are generally diagrammatic and indicative of the work; follow as closely as practicable. Neither the Drawings nor these Specifications are intended to show or describe every small construction detail. Complete the work in such manner that the various equipment and systems specified will function, operate and perform in the true intent and meaning of these Specifications.

B. Locations of equipment, piping, etc. shown are only approximately correct and are subject to modifications caused by structural conditions and equipment of other trades. No extra charges are allowed for such modifications. Obtain written approval for any changes contemplated before installation of the work.

C. Because of the small scale of Drawings, offsets that may be required to clear structural work or existing conditions may not be shown. Provide necessary offsets as required to complete the installation.

1.3 MECHANICAL SUBMITTALS

A. Refer to the General Provisions for Construction for submittal definitions, requirements, and procedures. Review of submittals is only for general conformance with the overall design concept, and general compliance with the standards and requirements specified herein.

B. Submittal of Shop Drawings, Product Data, and Samples will only be accepted when submitted by the Contractor. Data received directly from subcontractors and material suppliers will not be processed.

C. Perform field inspection of the existing mechanical systems prior to the initiation of any work. Include all mechanical equipment that is relevant to the work specified herein. Diagram and submit all findings to NJ TRANSIT.

D. Submit product data for specified materials and equipment, regardless of whether specific manufacturers and models or only general design requirements and reference standards are indicated. In addition, submit drawings of any other materials or equipment requiring filing or coordination with other trades, as well as any operating equipment specified elsewhere.

1.4 PERMITS, FEES, CODES AND STANDARDS

A. Complete Work in conformance to the NJ Uniform Construction Code (NJUCC), its adopted subcodes, and their referenced standards, whether or not specified herein, including, but not limited to, the following:
8. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
10. NAIMA National Insulation Standards.
11. Listing requirements of Underwriter’s Laboratories, ETL Testing Laboratories, Factory Mutual, Warnock-Hersey, or other testing firm acceptable to the authority having jurisdiction.

B. Complete construction permit application form and applicable subcode forms as required by the NJ Department of Community Affairs (NJDCA), Bureau of Construction Project Review, State Buildings Unit. Submit forms to NJDCA through NJ TRANSIT. NJ TRANSIT will pay for construction permit fees.

C. Ensure all work is inspected and approved by the NJDCA. Request periodic rough-in and final inspections as necessary in accordance with NJDCA requirements.

D. Do not request Acceptance for Substantial Completion for mechanical work until final inspection has been made and Certificate of Approval or Occupancy has been issued by the NJDCA.

E. Obtain mark-outs, permits and approvals from utility companies, and any other authorities having jurisdiction. Pay any fees required by the utility company.

F. Specific requirements of the NJUCC and its adopted subcodes supersede conflicting requirements of other documents specified herein, except that the Contract documents shall take precedence whenever they require materials, workmanship, arrangements or construction of higher standard or larger size than is required by codes and regulations.

1.5 TESTING LABORATORY CERTIFICATION

A. Ensure that all mechanical equipment bears approval label from Underwriter’s Laboratories, ETL/Intertek, Factory Mutual, Warnock-Hersey, or other testing firm acceptable to the authority having jurisdiction where certification or listing is furnished for the particular type of equipment.

1.6 QUALITY ASSURANCE

A. Provide, at the appropriate time or as directed, the services of a competent, factory-trained representative of the particular manufacturer of the equipment or
item involved, to inspect, adjust, and place in proper operating condition any and all such items of manufacturer. No additional compensation will be allowed the Contractor for such services.

B. Demonstrate the proper functioning of all plumbing, fire protection and HVAC systems equipment; and, equipment supplied by other trades included in the mechanical work.

1.7 WARRANTY

A. Refer to the General Provisions for Construction for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.

B. Compile and assemble the warranties specified into a separated set of vinyl covered, 3-ring binders, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond; duration of warranty or bond; and names, addresses and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.8 MANUFACTURER'S OPERATING INSTRUCTIONS

A. Refer to the General Provisions for Construction for procedures and submittal requirements for manufacturer's installation, operating and maintenance instructions. Refer to individual specification sections for equipment specific requirements.

B. Provide, for each item of equipment or apparatus furnished, printed instruction manuals obtained from the manufacturer covering the proper operation, care, lubrication, cleaning, servicing, adjusting and parts manuals, of the items involved, together with special safety instructions. Arrange for manufacturer's representative to instruct NJ TRANSIT personnel, who will operate the equipment, in all such details.

C. Provide charts and diagrams giving the number, location and function of each item, and including the following:
   1. Manufacturer;
   2. Product name;
   3. Model number;
   4. Serial number;
   5. Capacity;
   6. Operating and power characteristics;
   7. Labels of tested compliances; and,
   8. Similar essential data

D. Locate nameplates in an accessible and easily visible location.
1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.

B. Accept and store equipment and materials on site and inspect for damage, unless off-site storage is authorized in writing. Protect from corrosion and entrance of debris by storing above grade. Provide appropriate covering to protect stored equipment and materials from damage and exposure to weather.

C. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged; and protected to prevent damage during shipment, storage and handling.

D. Coordinate deliveries of materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

1.10 PROJECT RECORD DOCUMENTS

A. Submit under requirements of General Provisions for Construction.

B. Mark “AS-BUILT” drawings and specifications to indicate revisions to all equipment; approved substitutions and actual equipment and materials used; actual equipment locations; mechanical circuitry; Change Orders; and, concealed control system devices.

C. Mark “AS-BUILT” specifications to indicate approved substitutions; Change Orders; actual equipment and materials used.

1.11 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Verify routing and termination locations of piping and ductwork prior to rough-in.

C. Piping and duct routing are shown on Drawings in approximate locations unless dimensioned. Route as required to complete plumbing, fire protection or HVAC system, as applicable.

1.12 SCHEDULING

A. Schedule work to expedite collection of data to ensure completion of study for final approval of distribution equipment shop drawings prior to release of equipment for manufacturing.
PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. As specified in individual specification sections.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. Coordinate work with all trades involved. Follow overall Contract phasing plans.

B. Verify all dimensions by field measurements. Verify plumbing connections are as shown on Drawings.

C. Arrange for chases, slots, and openings to allow for mechanical installations.

D. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

E. Sequence, coordinate and integrate installations of mechanical materials and equipment for efficient flow of the work.

F. Coordinate the cutting and patching of components to accommodate the installation of mechanical equipment and materials. Perform patching using trade most proficient in repairing the particular materials and/or surfaces damaged.

G. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible.

H. Install mechanical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

I. Coordinate the installation of mechanical materials and equipment with structural components and electrical systems.

J. When two or more items of same material or equipment are required, provide products of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, wire, conduit, fittings, sheet metal, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in work, except as otherwise indicated.

K. Provide products that are compatible within systems and other connected items.
3.2 COOPERATION WITH OTHER TRADES

A. Cooperate with all other trades whose work might in any way affect Mechanical installations, and arrange work within all practical limits so that there will be no interference with the work of the various trades.

B. Where the work is concealed, provide advance planning as necessary to prevent projections beyond finished surfaces.

C. Assume full responsibility for damage caused by Mechanical work to the work of other trades during the execution of this Contract.

3.3 PIPING LAYOUT

A. Responsibility for accurate piping and ductwork layout and changes to the layout rests with the Mechanical Contractor. Changes to the layout to accommodate conditions arising during construction shall be made without additional compensation.
   1. Run piping straight and direct, neatly and evenly spaced, forming right angles or parallel lines with building walls and other conduit.
   2. Keep horizontal piping runs high and close to walls, except where concealed in construction.
   3. Install all piping and ductwork with necessary offsets as encountered to suit structural and other building conditions. Minimize use of offsets, but where necessary, keep close to underside of beams, joists and similar construction.
   4. Conceal work in finished spaces where feasible, and where shown.

B. Electrically lock out all mechanical equipment with tags until tested, and then lock out again until completion of all construction activities and normal service begins.

3.4 PAINTING

A. Thoroughly clean all work and leave same in a neat and workmanlike condition for the application of field painting.

B. If factory finishes, including prime coats on equipment, are marred, worn, rusted, or otherwise defaced, repaint same with two coats of enamel of matching color.

C. Apply two coats of rust inhibiting enamel paint to all concealed supports fabricated of ferrous metal that are not otherwise protected against corrosion.

D. Unless otherwise noted, paint all uninsulated ferrous metal piping in accordance with the color-coding requirements indicated in Section 15075.

3.5 ELIMINATION OF NOISE AND VIBRATION

A. Ensure all equipment and accessories operate without objectionable noise and vibration.
B. Should operation of any one or more of the systems produce noise or vibration which is objectionable, make changes in equipment and do all work necessary to eliminate the objectionable noise or vibration.

3.6 FINAL TESTS

A. Prior to requesting Acceptance for Substantial Completion for mechanical work, successfully perform all tests specified, deemed necessary to show proper execution of the work, and/or required by code in the presence of the Construction Manager, Engineer, and the appropriate NJDCA Subcode Inspector. Submit scheduling of all testing procedures for approval in advance.

B. Perform all tests and inspections of equipment, material, and wiring to determine whether all provisions of these Specifications and Drawings have been fulfilled. Test piping and ductwork for leakage and proper flow rates using suitable testing instruments. Lubricate all rotating equipment and check direction of rotation of all motors.

C. Where equipment supplied by other trades includes connections to plumbing, fire protection or HVAC systems, conduct testing that will prove proper functional performance specifically by the trade responsible for that equipment.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. The cost of this section shall be included in the lump sum bid item for DIVISION 15.

END OF SECTION
SECTION 15060
HANGERS AND SUPPORTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe hangers and supports.
   2. Hanger rods.
   3. Inserts.
   4. Sleeves.
   5. Mechanical sleeve seals.
   6. Formed steel channel.
   7. Equipment bases and supports.

B. Related Sections:
   1. Section 03100 - Concrete Forms and Accessories: Execution requirements for placement of inserts and sleeves in concrete forms specified by this section.
   2. Section 03300 - Cast-in-Place Concrete: Execution requirements for placement of concrete housekeeping pads specified by this section.
   3. Section 07840 - Firestopping: Product requirements for firestopping for placement by this section.
   4. Section 07900 - Joint Sealers: Product requirements for sealant materials for placement by this section.
   5. Section 09900 - Paints and Coatings: Product and execution requirements for painting specified by this section.
   7. Section 15105 - Pipes and Tubes: Execution requirements for placement of hangers and supports specified by this section.
   8. Section 15180 - Heating and Cooling Piping: Execution requirements for placement of hangers and supports specified by this section.

1.2 REFERENCES

A. ASTM International:
B. American Welding Society:
   1. AWS D1.1 - Structural Welding Code - Steel.

C. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
   2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
   3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

D. Underwriters Laboratories Inc.:
   1. UL - Fire Resistance Directory.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A. Firestopping Materials: ASTM E119; ASTM E814 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.

B. Surface Burning: ASTM E84 with maximum flame spread/smoke developed rating of 25/50.

C. Firestop interruptions to fire rated assemblies, materials, and components.

1.5 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to ASTM E119 for fire resistance ratings and ASTM E84 for surface burning characteristics.

B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.6 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.

C. Product Data:
   1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

E. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers. Submit sizing methods and calculations sealed by a licensed professional engineer registered in the State of New Jersey.

F. Manufacturer's Installation Instructions:
   1. Hangers and Supports: Submit special procedures and assembly of components.
   2. Firestopping: Submit preparation and installation instructions.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

H. Engineering Judgments: For conditions not covered by UL listed designs, submit judgments by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with NJ Uniform Construction Code, and its adopted subcodes, as indicated in Section 15010.

B. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Transport, handle, store, and protect products in accordance with the General Provisions for Construction.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Maintain environmental conditions required for products installed or stored on site in accordance with the General Provisions for Construction.

B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

D. Provide ventilation in areas to receive solvent cured materials.

1.11 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.12 WARRANTY

A. Provide product warranties and product bonds in accordance with the General Provisions for Construction.

B. Furnish five-year manufacturer’s warranty for pipe hangers and supports.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers:

1. Carpenter & Paterson Inc.
2. Creative Systems Inc.
3. Flex-Weld, Inc.
4. Globe Pipe Hanger Products Inc.
5. Michigan Hanger Co.
7. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Plumbing Piping - DWV:

1. Conform to MSS SP58; MSS SP69; and MSS SP89.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: [Malleable iron] [Carbon steel], adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
7. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
8. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.

C. Plumbing Piping - Water:
1. Conform to MSS SP58; MSS SP69; and MSS SP89.
2. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
3. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
5. Copper Pipe Support: Copper-plated, Carbon-steel ring.

D. Refrigerant Piping:
1. Conform to MSS SP58; MSS SP69; and MSS SP89.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: [Malleable iron] [Carbon steel,] adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
7. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
8. Copper Pipe Support: Copper-plated carbon-steel ring.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 INSERTS

A. Manufacturers:
1. B-Line Systems, Inc.
2. Unistrut Corp.
4. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Spot Inserts: Galvanized steel or malleable iron, with threaded connection or channel slot for hanger rods and insert nuts; lugs for attaching to forms; size inserts to suit threaded hanger rods.
C. Continuous Insert Channels: Minimum 12 gauge galvanized steel, with channel slot for hanger rods and insert nuts; welded or punched anchors; anchor end caps; size inserts to suit threaded hanger rods.

2.4 EXPANSION ANCHORS

A. Manufacturers:
   2. ITW Ramset/Red Head, “Trubolt” Model.
   5. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Description: Expanding wedge type with zinc-plated carbon steel stud, wedge, nut and washer, sized for load intended.

2.5 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18-gauge thick galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18-gauge thick galvanized steel.

C. Sleeves for Round Ductwork: Galvanized steel.

D. Sleeves for Rectangular Ductwork: Galvanized steel or wood.

E. Sealant: Acrylic; refer to Section 07900.

2.6 MECHANICAL SLEEVE SEALS

A. Manufacturers:
   1. Link-Seal Div., Thunderline Corp.
   2. CSD Sealing Systems.
   3. ProSet Systems, Inc.
   4. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.7 FORMED STEEL CHANNEL

A. Manufacturers:
2. Kindorf/Thomas & Betts Corp.
3. Unistrut Corp.
5. GS Metals Corp., “Globe-Strut.”
6. Versabar Corp.
7. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Product Description: ASTM A446/ASTM A525 zinc-coated or ASTM A570 painted steel for interior applications; ASTM A123 galvanized steel for exterior applications, with holes 1-1/2 inches on center.

2.8 FIRESTOPPING

A. Manufacturers:
1. 3M Corp., “Fire Barrier” CP 25WB or 2000N/S.
3. Hilti Corp., “FS-One”.
7. AD Fire Protection Systems, “FireBarrier”.
8. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
1. Silicone Firestopping Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

C. Color: As selected from manufacturer’s full range of colors to match adjacent finish.
2.9 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Dam Material: As recommended by firestopping product manufacturer. Use mineral fiber where manufacturer’s instructions are silent.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. General:
   1. Furnish NRTL listed products.
   2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:
   1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
   2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing or damming materials as required to arrest liquid material leakage.

D. Do not use powder-actuated anchors.

E. Do not drill or cut structural members.
3.3 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing/damming materials to arrest liquid material leakage.

D. Do not drill or cut structural members without written permission from Architect/Engineer.

3.4 INSTALLATION – ANCHORS AND INSERTS

A. Anchors and Fasteners:
   1. Concrete Structural Elements: Use precast/preset inserts or expansion anchors. Do not use powder-actuated fasteners.
   2. Steel Structural Elements: Use beam clamps, steel ramset fasteners, and welded fasteners. Do not use spring steel clips and clamps.
   3. Concrete Surfaces: Use expansion anchors.
   4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
   5. Solid Masonry Walls: Use expansion anchors or preset inserts.
   7. Wood Elements: Provide wood screws.

B. Inserts:
   1. Install inserts for placement in concrete forms.
   2. Install 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 recessed into and grouted flush with slab.

3.5 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with MSS SP 58; MSS SP 69; and MSS SP 89.

B. Support horizontal piping as scheduled.

C. Install hangers with minimum 1/2-inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.
E. Use hangers with 1-1/2 inch minimum vertical adjustment.

F. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

G. Support vertical piping as required by code.

H. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

I. Support riser piping independently of connected horizontal piping.

J. Provide copper plated hangers and supports for copper piping.

K. Design hangers for pipe movement without disengagement of supported pipe.

L. Prime coat exposed steel hangers and supports. Refer to Section 09900. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

M. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 15080.

3.6 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors minimum 1-inch above finished floor level. Caulk sleeves.

E. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with firestopping insulation and caulk. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install chrome plated steel escutcheons at finished surfaces.

3.7 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.
C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.

D. Compress fibered material to maximum 40 percent of its uncompressed size.

E. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.

F. Place intumescent coating in sufficient coats to achieve rating required.

G. Remove dam material after firestopping material has cured.

H. Fire Rated Surfaces:
   1. Seal opening at floor, wall, partition, ceiling, and roof penetrations as follows:
      a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
      b. Size sleeve allowing minimum of 1-inch void between sleeve and building element.
      c. Pack void with backing material.
      d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
   2. Where pipe, cable, conduit, wireway, and/or trough penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.

I. Non-Rated Surfaces:
   1. Seal opening through non-fire rated floor, wall, partition, ceiling, and roof penetrations as follows:
      a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
      b. Size sleeve allowing minimum of 1-inch void between sleeve and building element.
      c. Install type of firestopping material recommended by manufacturer.
   2. Install escutcheons, floor plates or ceiling plates where pipe or conduit penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
   3. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of pipe and tighten in place, in accordance with manufacturer's instructions.
   4. Interior partitions: Seal pipe penetrations at computer rooms, telecommunication rooms, and/or data rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.
3.8  FIELD QUALITY CONTROL
   A. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.9  CLEANING
   A. Clean adjacent surfaces of firestopping materials.

3.10 PROTECTION OF FINISHED WORK
    A. Protect adjacent surfaces from damage by material installation.

PART 4 COMPENSATION

4.1  MEASUREMENT AND PAYMENT
   A. Measurement: The work of this section shall not be measured.
    
   B. The cost of this section shall be included in the lump sum bid item for DIVISION 15.

END OF SECTION
SECTION 15075
MECHANICAL IDENTIFICATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Nameplates.
   2. Tags.
   3. Stencils.
   4. Pipe markers.
   5. Lockout devices.

B. Related Sections:
   1. Section 09900 - Paints and Coatings: Execution requirements for painting specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1.3 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Product Data: Submit manufacturers catalog literature for each product required.

C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

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

1.4 CLOSEOUT SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.
1.5 QUALITY ASSURANCE
A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.6 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 FIELD MEASUREMENTS
A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 NAMEPLATES
A. Manufacturers:
   1. Seton Identification Products Co.
   2. Brady Corp.
   3. EMED Co., Inc.
   5. Marking Systems, Inc.
   6. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Product Description: Laminated three-layer plastic with engraved black letters on white contrasting background color; minimum 1/8-inch thick.

C. Letter Size:
   1. 1/8-inch high letters for identifying individual equipment and loads.
   2. 1/4-inch high letters for identifying grouped equipment and loads.

2.2 TAGS
A. Manufacturers:
   1. Seton Identification Products Co.
   2. Brady Corp.
   3. EMED Co., Inc.
   5. Marking Systems, Inc.
   6. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter.

C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inches diameter square with finished edges.

D. Information Tags: Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.

E. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame plastic laminated.

2.3 STENCILS

A. Manufacturers:
   1. Seton Identification Products Co.
   2. Brady Corp.
   3. EMED Co., Inc.
   5. Marking Systems, Inc.
   6. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Stencils: With clean cut symbols and letters of following size:
   1. Up to 2 inches Outside Diameter of Insulation or Pipe: 1/2 inch high letters.

C. Stencil Paint: As specified in Section 09900, semi-gloss enamel, colors and lettering size conforming to ASME A13.1.

2.4 PIPE MARKERS

A. Manufacturers:
   1. Seton Identification Products Co.
   2. Brady Corp.
   3. EMED Co., Inc.
   5. Marking Systems, Inc.
   6. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Color and Lettering: Conform to ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
E. Plastic Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide x 4 mils thick, manufactured for direct burial service. Provide 2-inch wide metallic detection tape for plastic and cement piping.

2.5 CEILING TACKS

A. Manufacturers:
   1. Seton Identification Products Co.
   2. Brady Corp.
   3. EMED Co., Inc.
   5. Marking Systems, Inc.
   6. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Description: Steel with 3/4 inch diameter color-coded head.

C. Color code as follows:
   1. HVAC equipment: Yellow.
   2. Fire dampers/smoke dampers: Red.
   3. Plumbing valves: Green.
   5. Compressed air valves: White.

2.6 LOCKOUT DEVICES

A. Manufacturers:
   1. Seton Identification Products Co.
   2. Brady Corp.
   3. EMED Co., Inc.
   5. Marking Systems, Inc.
   6. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Lockout Hasps: Anodized aluminum Reinforced nylon hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

C. Valve Lockout Devices: Nylon Steel Plastic device preventing access to valve operator, accepting lock shackle.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.
B. Prepare surfaces in accordance with Section 09900 for stencil painting.

3.2 INSTALLATION

A. Apply stencil painting in accordance with Section 09900.

B. Install identifying devices after completion of coverings and painting.

C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

D. Install tags using corrosion resistant chain. Number tags consecutively by location.

E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

F. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates stencil painting. Identify in-line pumps and other small devices with tags.

G. Identify control panels and major control components outside panels with plastic nameplates.

H. Identify valves in main and branch piping with tags.

I. Identify air terminal units and radiator valves with numbered tags.

J. Tag automatic controls, instruments, and relays. Key to control schematic.

K. Identify piping, concealed or exposed, with plastic pipe markers plastic tape pipe markers stenciled 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.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. The cost of this section shall be included in the lump sum bid item for DIVISION 15.

END OF SECTION
SECTION 15080
MECHANICAL INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Piping system insulation.
2. Insulation accessories including vapor retarders, jackets, and accessories.

B. Related Sections:
1. Section 07840- Firestopping: Product requirements for firestopping for placement by this section.
2. Section 09900 - Paints and Coatings: Execution requirements for painting insulation jackets and covering specified by this section.
3. Section 15060 - Hangers and Supports: Product and Execution requirements for inserts at hanger locations.

1.2 REFERENCES

A. ASTM International:

1.3 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.
B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.
C. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.
D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

B. Maintain temperature during and after installation for minimum period of 24 hours.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 GLASS FIBER, RIGID

A. Manufacturers:
   1. Owens-Corning Fiberglas Corp., Type SSL-II.
   2. Knauf Fiber Glass, “1000”.
   4. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Insulation: ASTM C547; rigid, noncombustible.
   1. ‘K’ factor: ASTM C177 or ASTM C518, 0.23 at 75 degrees F.
   2. Maximum Service Temperature: 850 degrees F.
   3. Maximum Water Vapor Transmission: ASTM E96, 0.02 perm.
   4. Maximum Moisture Absorption: <0.2 percent by volume.
C. Vapor Retarder Jacket: ASTM C1136 flexible, Type II.

D. Facing: 1-inch galvanized steel hexagonal wire mesh stitched on one face of insulation.

E. Vapor Retarder Lap Adhesive:
   1. Manufacturers:
      b. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
   2. Fast-setting, water-resistant contact cement, compatible with insulation.

F. Insulating Cement/Mastic:
   1. Manufacturers:
      b. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
   2. ASTM C195; hydraulic setting on mineral wool.

2.2 CELLULAR GLASS

A. Manufacturers:
   2. Cell-U-Foam Corp.
   3. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Insulation: ASTM C552, Type II - pipe and tubing insulation, Class 2 - Jacketed.
   1. ‘K’ Factor: ASTM C177 or ASTM C518, 0.29 at 75 degrees F.
   2. Maximum Service Temperature: 900 degrees F.
   3. Maximum Water Vapor Transmission: ASTM E96, 0.00 perm.
   4. Maximum Moisture Absorption: ASTM C240, 0.2 percent by volume.
   5. Density: 7.5 lb/cu ft.

2.3 EXPANDED PERLITE

A. Manufacturers:
   1. Industrial Insulation Group LLC, “Sproule WR-1200.”
   2. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Molded expanded perlite block and pipe insulation: ASTM C610, pipe insulation for use on surfaces up to 1200 degree F.
   1. ‘K’ Factor: ASTM C177 or ASTM C518, 0.53 at 400 degrees F.
   2. Maximum Service Temperature: 1,200 degrees F.
   3. Density: 12.0 lb/cu ft.
2.4 HYDROUS CALCIUM SILICATE

A. Manufacturers:
   1. Industrial Insulation Group LLC, “Thermo 12 Gold.”
   2. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Calcium Silicate Block and Pipe Thermal Insulation: ASTM C533, Type I.
   1. ‘K’ Factor: ASTM C177 or ASTM C518, 0.50 at 400 degrees F.
   2. Maximum Service Temperature: 1,200 degrees F.

C. Tie Wire: 0.048-inch stainless steel with twisted ends on maximum 12-inch centers.

D. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement:
   1. Manufacturers:
      a. Industrial Insulation Group LLC, “CalCoat 127.”
      d. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
   2. ASTM C449/C449M.

2.5 EXPANDED POLYSTYRENE

A. Manufacturers:
   1. Dow Chemical Co., “Styrofoam.”
   2. Dyplast Products, LLC, “EPS.”
   3. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Unfaced Preformed Rigid Cellular Polystyrene Thermal Insulation: ASTM C591, Type III, compressive strength 50 psi.
   1. ‘K’ Factor: ASTM C177 or ASTM C518, 0.259 at 75 degrees F.
   2. Maximum Service Temperature: 165 degrees F.
   5. Density: 1.60 lb/cu ft.

2.6 POLYETHYLENE

A. Manufacturers:
   1. Nomaco K-Flex, “therma-cel SSL.”
   3. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
B. Preformed flexible closed cell polyethylene insulation: ASTM C1427; Tubular form.
   1. ‘K’ Factor: ASTM C177 or ASTM C518, 0.25 at 75 degrees F.
   2. Maximum Service Temperature: 200 degrees F.
   3. Maximum Water Vapor Transmission: ASTM E96, 0.05 perm.
   4. Maximum Moisture Absorption: ASTM C209, 0.0 percent by volume.
   5. Density: 1.5 lb/cu ft.

2.7 CELLULAR POLYISOCYANURATE

A. Manufacturers:
   2. Dyplast Products, LLC, “ISO-C1.”
   3. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. ASTM C591, Unfaced preformed rigid cellular polyisocyanurate thermal insulation, Type III.
   1. ‘K’ Factor: ASTM C177 or ASTM C518, 0.19 at 75 degrees F.
   2. Maximum Service Temperature: 300 degrees F.
   5. Density: 2.0 lb/cu ft.
   6. Compressive Strength: 50 psi.

2.8 CELLULAR PHENOLIC FOAM

A. Manufacturers:
   2. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Faced or unfaced rigid cellular phenolic pipe and board thermal insulation, ASTM C1126, Type II and Type III.
   1. ‘K’ Factor: ASTM C177 or ASTM C518, 0.125 at 50 degrees F.
   2. Maximum Service Temperature: 250 degrees F.
   3. Maximum Water Vapor Transmission: ASTM E96, 0.05 perm.
   4. Maximum Moisture Absorption: ASTM C209, 0.0 percent by volume.
   5. Density: 2.2 lb/cu ft.

2.9 ELASTOMERIC CELLULAR FOAM

A. Manufacturers:
   1. Armacell LLC, “AP Armaflex.”
   3. Aeroflex USA, Inc., “Aerocel EPDM.”
   4. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
B. Preformed flexible elastomeric cellular thermal insulation in sheet and tubular form: ASTM C534; Type I, Tubular form.
1. ‘K’ Factor: ASTM C177 or ASTM C518, 0.27 at 75 degrees F.
2. Maximum Service Temperature: 220 degrees F.
3. Maximum Water Vapor Transmission: ASTM E96, 0.10 perm.
4. Maximum Moisture Absorption: ASTM C209, 0.2 percent by volume.
5. Density: 3.0 to 6.0 lb/cu ft.

2.10 POLYETHYLENE/ELASTOMERIC CELLULAR FOAM INSULATION ADHESIVE

A. Manufacturers:
1. Armacell LLC, “Armaflex” Type 520.
2. Nomaco K-Flex, Type R-320.
4. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Air-dried, contact adhesive, compatible with insulation.

2.11 PIPE INSULATION AND EQUIPMENT JACKETS

A. PVC Jacket:
1. Manufacturers:
   c. Speedline Corp., “Smoke Safe.”
   d. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
2. Product Description: ASTM D1784, One piece molded type fitting covers and sheet material, off-white color.
3. Thickness: 15 mil.
4. Connections: Brush on welding adhesive or pressure sensitive color matching vinyl tape.

B. Stainless Steel Pipe Jacket:
1. Manufacturers:
   b. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
2. ASTM A240, Type 304 stainless steel with integral bonded moisture retarder.
3. Thickness: 0.016-inch thick.
5. Fittings: 0.016-inch thick die shaped fitting covers with factory attached protective liner.
6. Metal Jacket Bands: ½- inch wide; 0.015-inch thick stainless steel.

C. Covering Adhesive Mastic:
1. Manufacturers:
b. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

2. Compatible with insulation.

D. Lagging Adhesive:
1. Manufacturers:
   b. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
2. Quick-setting, water based fiberglass reinforced lagging adhesive, compatible with insulation.

PART 3 EXECUTION

3.1 EXAMINATION
A. Verify piping has been tested before applying insulation materials.
B. Verify surfaces are clean and dry, with foreign material removed.

3.2 PIPE INSULATION INSTALLATION
A. Exposed Piping: Locate insulation and cover seams in least visible locations.
B. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
C. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.
D. Man made mineral fiber insulated pipes conveying fluids above ambient temperature:
   1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
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.

E. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 07840 for penetrations of assemblies with fire resistance rating greater than one hour.

F. Exterior Applications: Provide vapor retarder jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor retarder cement. Cover with aluminum or stainless steel jacket with seams located at 3 or 9 o’clock position on side of horizontal piping with overlap facing down to shed water or on bottom side of horizontal equipment.

G. Buried Piping: Insulate only where insulation manufacturer recommends insulation product may be installed in trench, tunnel or direct buried. Install factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with 1 mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with polyester film.

3.3 PIPE INSULATION SCHEDULES

A. Plumbing Systems:

B. Cooling Systems:
   1. Refrigerant Piping:
      a. Glass Fiber Insulation:
         1) Pipe Size Range: All sizes.
         2) Thickness: ½-inch.
      b. Polyethylene Insulation:
         1) Pipe Size Range: All sizes.
         2) Thickness: ½-inch.
      c. Cellular Elastomeric Foam Insulation:
         1) Pipe Size Range: All sizes.
         2) Thickness: ½-inch.

   2. Condensate Drains from Cooling Coils:

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.
B. Payment: The cost of this section shall be included in the lump sum bid items PLUMBING, HVAC SYSTEMS, as applicable to the system served.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Pipe and pipe fittings for the following systems:
   1. Equipment drains and over flows.
   2. Anti-freeze piping.
   3. Unions and flanges.
   5. Bedding and cover materials.

B. Related Sections:
   1. Section 02060 - Aggregate: Aggregate for backfill in trenches.
   2. Section 02315 - Excavation and Fill: Product and execution requirements for excavation and backfill required by this section.
   3. Section 02320 - Backfill: Execution requirements for backfilling required by this section.
   4. Section 02324 - Trenching: Execution requirements for trenching for underground piping systems.
   5. Section 07840 - Firestopping: Product requirements for firestopping for placement by this section.
   6. Section 09900 - Paints and Coatings: Product and execution requirements for painting specified by this section.
   7. Section 15060 - Hangers and Supports: Product requirements for pipe hangers and supports and firestopping for placement by this section.
   8. Section 15070 - Mechanical Sound, Vibration, and Seismic Control: Product requirements for vibration isolation for placement by this section.
   9. Section 15080 - Mechanical Insulation: Product requirements for piping insulation for placement by this section.
   10. Section 15110 - Valves: Product requirements for valves for placement by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
   2. ASME B16.3 - Malleable Iron Threaded Fittings.
   3. ASME B16.4 - Gray Iron Threaded Fittings.
   4. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
   5. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
   6. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings (DWV).
   7. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
8. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
10. ASME B31.9 - Building Services Piping.
11. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.
12. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:
29. ASTM D2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.
41. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
42. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
44. ASTM D3262 - Standard Specification for Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.
46. ASTM D3517 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe.
47. ASTM D3754 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer and Industrial Pressure.


C. American Welding Society:
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1 - Structural Welding Code - Steel.

D. American Water Works Association:
3. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
6. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.
7. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in., for Water Service.
8. AWWA C950 - Fiberglass Pressure Pipe.

E. Cast Iron Soil Pipe Institute:

F. National Fire Protection Association:
   1. NFPA 30 - Flammable and Combustible Liquids Code.
   2. NFPA 31 - Standard for the Installation of Oil-Burning Equipment.

1.3 SUBMITTALS

A. Submit under the requirements of the General Provisions for Construction.

B. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, and sizes.

C. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.

D. Design Data: Indicate pipe sizes. Indicate pipe sizing methods. Indicate calculations used. Submit sizing methods and calculations sealed by registered professional engineer.

E. Welders' Certificate: Include welders’ certification of compliance with ASME Section IX or AWS D1.1.

1.4 QUALITY ASSURANCE


B. Perform Work in accordance with ASME Section IX for welding materials and procedures.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience and approved by manufacturer.
C. Where indicated, design piping systems, pipe hangers and supports under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of New Jersey.

1.6 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.

B. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 COORDINATION

A. Coordinate installation of buried piping with trenching.

PART 2 PRODUCTS

A. Copper Tubing: ASTM B88, Type L, annealed.
   2. Joints: Compression connection or Brazed, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

B. Copper Tubing: ASTM B42, hard drawn.
   1. Fittings: ASME B16.18 cast copper alloy or ASME B16.22 wrought copper and bronze.
   2. Joints:
      a. Soldered: ASTM B32, lead free, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.
      b. Brazed: AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

C. Copper Tubing: ASTM B42, annealed.

2.2 STORM WATER PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Refer to Section 02630.

2.3 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74, extra heavy weight, bell and spigot ends.
   1. Fittings: Cast iron, ASTM A74.
   2. Joints: ASTM C564, rubber gasket joint devices or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron, CISPI 301.

C. Copper Tube: ASTM B306, DWV.
   2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

D. PVC Pipe: ASTM D2665, polyvinyl chloride (PVC) material.

E. PVC Pipe: ASTM F1866, polyvinyl chloride (PVC) material.
   1. Fittings: PVC, ASTM F1866.

2.4 STORM WATER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74 service weight, bell and spigot ends.
   1. Fittings: Cast iron, ASTM A74.
   2. Joints: ASTM C564, neoprene gasket system or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron, CISPI 301.

C. Copper Tube: ASTM B306, DWV.
   2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

D. PVC Pipe: ASTM D2665, polyvinyl chloride (PVC) material.

E. PVC Pipe: ASTM F1866, polyvinyl chloride (PVC) material.
1. Fittings: PVC, ASTM F1866.

F. Copper Tubing: ASTM B88, Type [K,] [L,] [M,] hard drawn.
1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
2. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
3. Joints: Soldered or brazed.
   a. Soldered: Lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535°F.
   b. Brazed: AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480°F.

G. Copper Tubing: ASTM B88, Type [M,] [L,] [K,] hard drawn, rolled grooved ends.
1. Fittings: [ASME B16.18 cast copper alloy,] [or] [ASME B16.22 wrought copper and bronze,] [or] [ASTM B584 bronze sand castings,] grooved ends.
2. Joints: Grooved mechanical couplings meeting ASTM F1476.
   a. Housing Clamps: ASTM A395/A395M and ASTM A536 ductile iron, enamel coated, compatible with copper tubing sizes, to engage and lock designed to permit some angular deflection, contraction, and expansion.
   b. Gasket: Elastomer composition for operating temperature range from [-30] [86] [________] degrees F to [230] [180] [________] degrees F.
   c. Accessories: [Steel] [Stainless steel] bolts, nuts, and washers.

2.5 REFRIGERANT PIPING

A. Copper Tubing: ASTM B280, Type ACR hard drawn or annealed.
2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

2.6 EQUIPMENT DRAINS AND OVERFLOWS

1. Fittings: ASME B16.3, malleable iron or ASME B16.4, cast iron.
2. Joints: Threaded for pipe 2 inch and smaller; flanged for pipe 2-1/2 inches and larger.

B. Copper Tubing: ASTM B88, Type DWV, hard drawn.
1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

C. PVC Pipe: ASTM D1785, Schedule 40, and Schedule 80 for sizes 8 inch and larger, or ASTM D2241, SDR 21 or 26, polyvinyl chloride (PVC) material.
   1. Fittings: [ASTM D2466, Schedule 40, PVC] [ASTM D2467, Schedule 80, PVC] [ASTM D2464 PVC, threaded].

D. ABS Pipe: ASTM D2680 or ASTM D2751, Acrylonitrile-Butadiene-Styrene (ABS) material.

2.7 ANTI-FREEZE PIPING

A. Copper Tubing: ASTM B88, Type L, annealed.
   2. Joints: Compression connection or Brazed, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

B. Copper Tubing: ASTM B42, hard drawn.
   1. Fittings: ASME B16.18 cast copper alloy or ASME B16.22 wrought copper and bronze.
   2. Joints:
      a. Soldered: ASTM B32, lead free, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.
      b. Brazed: AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

C. Copper Tubing: ASTM B42, annealed.

2.8 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
   1. Ferrous Piping: Class 150, malleable iron, threaded.
   2. Copper Piping: Class 150, bronze unions with soldered or brazed joints.
   3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
   4. Stainless Steel Piping: 300 psig, threaded type with compression type ends.
   5. PVC Piping: PVC.

B. Flanges for Pipe 2-1/2 inches and Larger:
   1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
   2. Copper Piping: Class 150, slip-on bronze flanges.
   3. PVC Piping: PVC flanges.

C. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe.

2.9 UNDERGROUND PIPE MARKERS
A. Refer to Section 15075.

2.10 BEDDING AND COVER MATERIALS
A. Bedding: Fill Type A5 or A6, as specified in Section 02060.
B. Cover: Fill Type A5 or A6, as specified in Section 02060.
C. Soil Backfill from Above Pipe to Finish Grade: Soil Type S1, S2 or S3, as specified in Section 02055.

PART 3 EXECUTION

3.1 EXAMINATION
A. Verify excavations are to required grade, dry, and not over-excavated.
B. Verify trenches are ready to receive piping.

3.2 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.
D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - BURIED PIPING SYSTEMS
A. Verify connection [to existing piping system] size, location, and invert are as indicated on Drawings.
B. Establish elevations of buried water distribution piping with not less than 42 inches of cover.
C. Establish elevations of buried sanitary and storm sewer piping with not less than 24 inches of cover.
D. Establish minimum separation of 12 inches from other service piping in accordance with NJUCC Plumbing Subcode.

E. Excavate pipe trench in accordance with Section 02324.

F. Install pipe to elevation as indicated on Drawings.

G. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth; compact to 95 percent maximum density.

H. Install pipe on prepared bedding.

I. Route pipe in straight line.

J. When installing piping in PVC protector pipe install both carrier pipe and protector pipe using long sweep elbows.

K. Install pipe to allow for expansion and contraction without stressing pipe or joints.

L. Install shutoff and drain valves at locations indicated on Drawings in accordance with this Section and Section 15110.

M. Install plastic ribbon tape continuous buried minimum 6 to 8 inches below finished grade, directly above buried pipe. Use metallic detection tape for plastic and cement piping. Refer to Section 15075.

N. Pipe Cover and Backfilling:
   1. Backfill trench in accordance with Section 02320.
   2. Maintain optimum moisture content of fill material to attain required compaction density.
   3. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 12 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
   4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
   5. Do not use wheeled or tracked vehicles for tamping.

3.4 INSTALLATION - ABOVE GROUND PIPING

A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

C. Group piping whenever practical at common elevations.
D. Sleeve pipe passing through partitions, walls and floors. Refer to Section 15060.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 15125.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 15080.

G. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Section 08310.

H. Install non-conducting dielectric connections wherever jointing dissimilar metals.

I. Establish invert elevations, slopes for drainage to 1/8-inch per foot minimum. Maintain gradients.

J. Slope piping and arrange systems to drain at low points.

K. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

L. Install piping penetrating roofed areas to maintain integrity of roof assembly.

M. Install valves in accordance with Section 15110.

N. Install piping specialties in accordance with Section 15120.

O. Insulate piping. Refer to Section 15080.

P. Install pipe identification in accordance with Section 15075.

3.5 INSTALLATION - REFRIGERATION PIPING

A. Install refrigeration piping in accordance with Section 15184.

3.6 FIELD QUALITY CONTROL

A. Pressure test refrigeration piping in accordance with the requirements of Chapter 11 of the NJUCC Mechanical Subcode, and the air conditioning system equipment manufacturer’s instructions.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.
B. Payment: The cost of this section shall be included in the lump sum bid item for DIVISION 15.

END OF SECTION
SECTION 15110
VALVES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Gate valves.
   2. Globe valves.
   3. Check valves.

B. Related Sections:
   1. Section 15060 - Hangers and Supports: Product and installation requirements for pipe hangers and supports.
   2. Section 15105 - Pipes and Tubes: Product and installation requirements for piping materials applying to various system types.
   3. Section 15160 - Storm Drainage Piping: Product and installation requirements for valves used in storm drainage systems.
   4. Section 15184 - Refrigerant Piping: Product and installation requirements for valves used in refrigeration and air conditioning systems.

1.2 REFERENCES

A. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP 67 - Butterfly Valves.
   2. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
   3. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
   4. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
   5. MSS SP 85 - Cast Iron Globe & Angle Valves, Flanged and Threaded.

1.3 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Product Data: Submit manufacturers catalog information with valve data and ratings for each service.

C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
1.4 CLOSEOUT SUBMITTALS
A. Submit in accordance with General Provisions for Construction.
B. Project Record Documents: Record actual locations of valves.
C. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.5 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum ten years documented experience.
B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.
B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
C. Provide temporary protective coating on cast iron and steel valves.

1.7 WARRANTY
A. Furnish five-year manufacturer warranty for valves, excluding packing.

1.8 EXTRA MATERIALS
A. Furnish two packing kits for each size valve.

PART 2 PRODUCTS

2.1 GATE VALVES
A. 2 inches and Smaller:
   1. Manufacturers:
      a. NIBCO, Inc., Model T-111 or S-111.
      b. Milwaukee Valve Company, Model 148 or 149.
      c. Watts Industries, Inc., Series GV or GVS.
      d. Stockham Valves & Fittings, Model B-100 or B-108.
      e. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
2. MSS SP-80, Class 125, bronze body, bronze trim, rising stem, handwheel, inside screw, solid wedge disc, solder or threaded ends.

2.2 GLOBE VALVES

A. 2 inches and Smaller:
   1. Manufacturers:
      a. NIBCO, Inc., Model T-211 or S-211.
      b. Milwaukee Valve Company, Model 502 or 1502.
      c. Watts Industries, Inc., Series GLV.
      d. Stockham Valves & Fittings, Model B-16 or B-17.
      e. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
   2. MSS SP-80, Class 125, bronze body, bronze trim, handwheel, bronze disc with teflon seat, solder or threaded ends.

2.3 SWING CHECK VALVES

A. 2 inches and Smaller:
   1. Manufacturers:
      a. NIBCO, Inc., Model T-413 or S-413.
      b. Milwaukee Valve Company, Model 509 or 1509.
      c. Watts Industries, Inc., Series CV or CVS.
      d. Stockham Valves & Fittings, Model B-309 or B-319.
      e. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
   2. MSS SP-80, Class 125, bronze body and cap, bronze swing disc with rubber seat, solder or threaded ends.
   3. MSS SP-71, Class 125, iron body, bronze swing disc, renewable disc seal and seat, flanged or grooved ends.

2.4 SPRING LOADED CHECK VALVES:

A. 2 inches and Smaller:
   1. Manufacturers:
      a. NIBCO, Inc., Model T-480 or S-480.
      b. Milwaukee Valve Company, Model 548.
      c. Watts Industries, Inc., Series CV or CVS.
      d. Stockham Valves & Fittings, Model B-316.
      e. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
   2. Class 125, bronze body and trim, stainless steel springs, solder or threaded ends.
PART 3 EXECUTION

3.1 EXAMINATION
   A. Verify piping system is ready for valve installation.

3.2 INSTALLATION
   A. Install valves with stems upright or horizontal, not inverted.
   B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
   C. Install 3/4-inch gate or ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.
   D. Install valves with clearance for installation of insulation and allowing access.
   E. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Section 08310.
   F. Refer to Section 15060 for pipe hangers.

3.3 VALVE APPLICATIONS
   A. Install shutoff and drain valves at locations indicated on Drawings in accordance with this Section.
   B. Install ball, butterfly or gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.
   C. Install ball, butterfly or globe valves for throttling, bypass, or manual flow control services.
   D. Install spring loaded check valves on discharge of pumps.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT
   A. Measurement: The work of this section shall not be measured.
   B. Payment: The cost of this section shall be included in the lump sum bid item for DIVISION 15.

END OF SECTION
SECTION 15184

REFRIGERANT PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Refrigerant piping.

B. Related Sections:
   1. Section 15060 - Hangers and Supports: Product requirements for pipe hangers and supports, sleeves, and firestopping for placement by this section.
   2. Section 15075 - Mechanical Identification: Product requirements for pipe identification for placement by this section.
   3. Section 15080 - Mechanical Insulation: Product requirements for Piping Insulation for placement by this section.
   4. Section 15739 - Split System Air Conditioning Units.

1.2 REFERENCES

A. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

B. American Society of Mechanical Engineers:
   1. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

C. ASTM International:

D. American Welding Society:
   1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

1.3 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.

B. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves or equipment.

C. Provide pipe hangers and supports in accordance with Section 15060.
D. Flexible Connectors: Use at or near compressors where piping configuration does not absorb vibration.

1.4 SUBMITTALS
A. Submit in accordance with General Provisions for Construction.
B. Shop Drawings: Indicate layout of refrigeration piping system, including equipment, critical dimensions, and sizes.
C. Product Data: Submit data on pipe materials, fittings, and accessories.
D. Test Reports: Indicate results of refrigerant leak test and piping system pressure test.
E. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures and isolation.
F. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

1.5 CLOSEOUT SUBMITTALS
A. Submit in accordance with General Provisions for Construction.
B. Project Record Documents: Record actual locations of piping, valves, equipment and refrigerant accessories.
C. Operation and Maintenance Data: Submit instructions for installation and changing components, spare parts lists, exploded assembly views.

1.6 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
B. Fabricator or Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING
A. Transport, handle, store, and protect products in accordance with the General Provisions for Construction.
B. Dehydrate and charge refrigeration components including piping and receivers, and seal prior to shipment. Maintain seal until connected into system.
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.

1.8 FIELD MEASUREMENTS
A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 REFRIGERANT PIPING
A. Copper Tubing: ASTM B280, Type ACR hard drawn or annealed.
   2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

PART 3 EXECUTION

3.1 PREPARATION
A. Ream pipe and tube ends. Remove burrs.
B. Remove scale and dirt on inside and outside before assembly.
C. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.2 INSTALLATION - PIPE HANGERS AND SUPPORTS
A. Install pipe hangers and supports in accordance with Section 15060.

3.3 INSTALLATION - PIPING SYSTEMS
A. Route piping parallel to building structure and maintain gradient.
B. Install piping to conserve building space, and not interfere with use of space.
C. Group piping whenever practical at common elevations.
D. Sleeve pipe passing through partitions, walls and floors. Refer to Section 15060.
E. Install pipe identification in accordance with Section 15075.
F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
G. Provide access where valves and fittings are not exposed.
H. Arrange refrigerant piping to return oil to compressor. Slope horizontal piping 0.40 percent in direction of flow.

I. Flood refrigerant piping system with nitrogen when brazing.

J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

K. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.

L. Insulate piping; refer to Section 15080.

M. Fully charge completed system with refrigerant after testing.

N. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.

3.4 INSTALLATION - REFRIGERANT SPECIALTIES

A. Install in accordance with air conditioning system equipment manufacturer’s instructions. Refer to the requirements below unless otherwise directed by those instructions.

3.5 FIELD QUALITY CONTROL

A. Pressure test refrigeration piping in accordance with the requirements of Chapter 11 of the NJUCC Mechanical Subcode, and the air conditioning system equipment manufacturer’s instructions. Refer to Section 15739.

B. Repair leaks.

C. Retest until no leaks are detected.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item Division 15.
SECTION 15440
PLUMBING PUMPS

PART 1 GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Oil sensing submersible elevator sump pump.
   2. Pump accessories and appurtenances.

1.2 REFERENCES
A. ASTM International:

B. National Fire Protection Association:
   1. NFPA 70 – National Electrical Code

C. Underwriter’s Laboratories:
   1. UL 508 – Industrial Control Equipment.
   2. UL 778 – Motor-Operated Water Pumps.

1.3 SUBMITTALS
A. Submit in accordance with General Provisions for Construction.

B. Shop Drawings: Submit installation details for pumps, piping, controls and accessories including wiring schematics.

C. Product Data: Submit data for specified Products.

D. Manufacturer’s Certificates: Submit Statement of Compliance, supporting data, from material suppliers attesting that pumps provided meet or exceed performance criteria and conform to specification requirements.

1.4 CLOSEOUT SUBMITTALS
A. Submit in accordance with General Provisions for Construction.

B. Operation and Maintenance Data: Submit installation instructions, servicing requirements, assembly views, lubrication instructions, and replacement parts list.
1.5 QUALIFICATIONS

A. Manufacturer: company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience and approved by manufacturer.

1.6 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE AND HANDLING

A. Transport, handle, store, and protect products in accordance with the General Provisions for Construction.

B. Prepare pumps and accessories for shipment to prevent entry of foreign matter into product body.

C. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Maintain environmental conditions required for products installed or stored on site in accordance with the General Provisions for Construction.

B. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

1.9 COORDINATION

A. Coordinate work with utilities within construction area.

1.10 MAINTENANCE MATERIALS

A. Furnish special tools required for equipment maintenance.

1.11 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.
PART 2 PRODUCTS

2.1 PUMPS

A. Manufacturers:
   1. Stancor Inc.; Model Oil Minder SE100 and SE50; Provide each pump with
      unibody float and probe system, model Stancor OM-300
   2. Substitutions: Submit requests for substitution in accordance with the
      General Provisions for Construction..

B. Description: UL 778; Submersible oil-sensing pump with stainless steel/
   polycarbonate housing, vortex type non-clog impeller, float switch activation,
   remote control panel, and control cabling.
   1. Capacity:
      a. SP-1: 50 GPM at 30 feet TDH design point.
      b. SP-2: 50 GPM at 20 feet TDH design point.

C. Motor: 115 volt, 1 phase, 60 Hz, 0.4 hp, 3600 rpm maximum; non-overloading
   throughout entire range of pump curve.

D. Oil Sensor: Self-cleaning, hermetically sealed stainless steel probe capable of
   distinguishing between oil contaminated effluent and wastewater.

E. Control Panel: UL 508; NEMA 4X weathertight polycarbonate enclosure with
   solid state monitoring circuitry, LED type indicator lights, water tight alarm horn,
   alarm silencing and reset switches, pin-type control cable receptacle, internal
   terminal strip, and single point power connection cord/plug.
   1. Indicator Lights:
      a. Power.
      b. Pump operating.
      c. Oil detection.
      d. High liquid level.
      e. Motor overload.
   2. Float Switches: Sealed float-type mercury switches in shock-resistant
      solid polyurethane, with heavy neoprene-jacketed weighted cords.
      a. Pump activation.
      b. High liquid level alert.
   3. Pump Operation:
      a. On rise of liquid level, pump activation float switch energizes
         pump.
      b. If liquid level drops below oil sensor probe, pump shuts off.
      c. If high-level liquid alarm float switch remains activated 30 seconds
         after pump energizes, audible alarm is sounded.
      d. If oil sensor probe detects presence of oil, audible alarm is
         sounded, and pumps are locked out of operation until system is
         manually reset.
2.2 PUMP DISCHARGE PIPING
   A. Refer to Section 15150.
   B. Provide check valve with hydraulically sealed, quick disconnect, discharge flange
      and globe valve with stem extension in pump discharge line.

2.3 APPURTENANCES
   A. Fasteners and Hardware: Stainless steel.

PART 3 EXECUTION

3.1 EXAMINATION
   A. Verify existing conditions before starting work.
   B. Verify connections, size, and location are as indicated on Drawings.
   C. Verify electrical power is of correct voltage and operating characteristics.

3.2 INSTALLATION
   A. Install pumps in elevator sumps in accordance with manufacturer’s instructions.
   B. Provide necessary piping, fittings, and valves as indicated on Drawings.

3.3 FIELD QUALITY CONTROL
   A. Upon completion of installation, examine, adjust and test each unit for proper
      operation under direction of manufacturer’s representative.
   B. Check and adjust liquid level control and alarm settings.
   C. Test each pump with clean water through minimum of four complete cycles of lift
      station including high-level and low-level conditions to demonstrate correct pump
      operation, control settings, alarm settings, freedom from pump vibration, noise
      and overheating. Provide water as required for testing purposes.
   D. Demonstrate with each pump provision for pump removal, service and
      replacement.

3.4 MANUFACTURER’S FIELD SERVICES
   A. Provide services of manufacturer's representative for period of not less than 1
      man day to inspect installations, and conduct performance testing and training.
PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item Division 15.

END OF SECTION
SECTION 15739
SPLIT SYSTEM AIR CONDITIONING UNITS

PART 1 GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Air handling units.
   2. Condensing units.
   3. Accessories and controls.
B. Related Sections:
   2. Section 15150 - Sanitary Waste and Vent Piping: Execution requirements for connection to condensate drainage piping specified by this section.
   3. Section 15184 - Refrigerant Piping.
   4. Section 15940 - Sequence of Operation: Sequences of operation applying to units in this section.
   5. Section 16150 - Wiring Connections: Electrical connection to units.

1.2 REFERENCES
A. Air-Conditioning and Refrigeration Institute:
   2. ARI 270 - Sound Rating of Outdoor Unitary Equipment.
B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
C. National Electrical Manufacturers Association:
   1. NEMA MG 1 - Motors and Generators.

1.3 SUBMITTALS
A. Submit in accordance with General Provisions for Construction.
B. Product Data: Submit data indicating:
   1. Cooling and heating capacities.
   2. Dimensions.
   3. Weights.
   4. Rough-in connections and connection requirements.
   5. Duct connections.
6. Electrical requirements with electrical characteristics and connection requirements.
7. Controls.
8. Accessories.

C. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

E. Manufacturer's Field Reports: Submit start-up report for each unit.

1.4 CLOSEOUT SUBMITTALS
A. Submit in accordance with General Provisions for Construction.
B. Project Record Documents: Record actual locations of controls installed remotely from units.
C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

1.5 QUALITY ASSURANCE
A. Performance Requirements:
   1. Energy Efficiency Rating (EER): Not less than prescribed by ASHRAE 90.1 when used in combination with compressors and evaporator coils when tested in accordance with ARI 210/240.
B. Cooling Capacity: Rate in accordance with ARI 210/240.
C. Sound Rating: Measure in accordance with ARI 270.
D. Ensure that equipment bears approval label from Underwriter's Laboratories, ETL/Intertek, Factory Mutual, Warnock-Hersey, or other testing firm acceptable to the authority having jurisdiction where certification or listing is furnished for the particular type of equipment.

1.6 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.
B. Installer: Company specializing in performing Work of this section with minimum five years documented experience and approved by manufacturer.
1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.

B. Provide dry air holding charge in the indoor section.

C. Pre-charge outdoor unit with R-410a refrigerant for 70 feet of refrigerant tubing.

D. Accept units and components on site in factory protective containers, with factory shipping skids and lifting lugs. Inspect for damage.

E. Comply with manufacturer’s installation instruction for rigging, unloading and transporting units.

F. Protect units from weather and construction traffic by storing in dry, roofed location.

1.8 COORDINATION

A. Coordinate installation of condensing units with platform steel and concrete housekeeping pads.

B. Coordinate installation of air handling units with building structure.

1.9 WARRANTY

A. Furnish five-year manufacturer’s warranty for compressors.

1.10 MAINTENANCE SERVICE

A. Furnish service and maintenance of equipment for one year from Date of Substantial Completion. Include maintenance items as shown in manufacturer's operating and maintenance data, including filter replacements, fan belt replacement, and controls checkout and adjustments.

B. Furnish 24-hour emergency service on breakdowns and malfunctions for this maintenance period. Furnish capability of response time within 4 hours.

PART 2 PRODUCTS

2.1 INDOOR UNIT

A. Manufacturers:
   1. Mitsubishi Electric, Inc., “Mr. Slim” Model PKA-A18GA, or approved equal.
   2. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
B. Description: Factory assembled, wired and tested high wall fan coil unit with control/power wiring, refrigeration piping, control circuit board, fan motor, and integral wall mounting bracket.

C. Cabinet: Fabricated of high strength white molded plastic, with front panel filter access, factory applied insulation, and wall mounting plate.

D. Evaporator Fan: Two-speed, high performance, double inlet, forward curve, direct drive sirocco fan; statically and dynamically balanced, with permanently lubricated motor.

E. Vanes:
1. Horizontal: Motorized to automatically direct air flow in a horizontal and downward direction for uniform air distribution; decrease downward air resistance for lower noise levels; and close the outlet port when operation is stopped.
2. Vertical: Provide horizontal swing airflow movement selected by remote control.

F. Evaporator Coil: Multi-angled heat exchanger of non-ferrous construction, with pre-coated, low-resistance aluminum strake fins on copper tubing; phos-copper or silver alloy brazed tube joints pressure tested at the factory; condensate pan with internal trap; and auxiliary drip pan and drain under the coil.

G. Refrigeration System: Single refrigeration circuits controlled by factory installed piston type refrigerant metering device.

H. Air Filters: Washable permanent type.

I. Electrical Characteristics: 208 volts, single phase, 60 Hz.

2.2 CONDENSING UNIT

A. Manufacturers:
1. Mitsubishi Electric, Inc., Model PUZ-A24NHA-BS, or approved equal.
2. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. General: Factory assembled, piped, and wired and tested air-cooled condensing unit, fully compatible with the indoor unit controls and capacity, consisting of casing, compressor, condenser, coils, condenser fan and motor, condensate pump and unit controls and interface board.
1. Minimum Operating Temperature: 0°F ambient without supplemental low ambient controls.
2. Maximum Operating Height Difference: 100 feet between indoor and outdoor units.
3. Factory Rated Refrigerant Tubing Length: Pre-charged for a maximum distance of 70 feet.
4. Maximum Refrigerant Tubing Length: 165 feet without the need for line size changes, traps or additional oil.

C. Unit Casing: Galvanized steel with electrostatically applied, thermally fused acrylic or polyester powder coating and munsell 3Y 7.8/1.1 finish; and ABS plastic fan grille.

D. Compressor: DC rotary compressor with variable speed inverter drive to dynamically match the room load; intermittently applied compressor motor current to prevent liquid accumulation in the compressor during the off cycle; accumulator; and high pressure safety switch. Mount to avoid transmission of vibration.

E. Condenser Coil: The L shaped condenser coil shall be of copper tubing with flat aluminum fins to reduce debris build up. The coil shall be protected with an integral metal guard. Refrigerant flow from the condenser shall be controlled by means of linear expansion valve (LEV) metering orifice. The LEV shall be control by a microprocessor controlled step motor.

F. Electrical Characteristics: 208 volts, single phase, 60 Hz.

G. Controls: Furnish operating and safety controls including high and low pressure cutouts, control transformer, and magnetic contactors for compressor and condenser fan motors. Activate outdoor unit via pulse signal 24 volts DC control signal from microprocessor located in the indoor unit. Provide pulse amplitude modulation circuit to utilize 98% of input power supply.

H. Condenser Fans and Drives: Horizontal discharge airflow fan mounted in front of the coil, with raised guard to prevent contact with moving parts and permanently lubricated motor bearings.

I. Condensing Unit Accessories:
   1. Low ambient cooling control to -20 degrees F.
   2. Time delay relay.
   3. Anti-short cycle timer.
   4. Disconnect switch.
   5. PVC coated steel wire condenser guard.

J. Refrigeration specialties: Furnish the following:
   1. Mixed phase line service valve.
   2. Suction line service valve with gauge port.
   3. Compressor suction/discharge service gauge ports with Schrader fittings.
   4. Charge of compressor oil.
   5. Holding charge of refrigerant.
   6. Accumulator.
   7. Pressure relief device.

K. Refrigerant: Furnish charge of refrigerant R-410A.
L. Capacity: As scheduled on Drawings.

### 2.3 CONTROLS

A. Description: Wall mounted microprocessor-based system with liquid crystal display, controlling space temperature, optimum fan speed, and self-diagnostic checks, with 67°F to 87°F temperature control range. Interconnect indoor and outdoor unit microprocessors with single, non-polar, two-wire cable with no splices. Include the following functions:

1. Automatic restart after power failure at the same operating conditions as at failure;
2. Timer function providing minimum 24-hour timer cycle for system automatic Start/Stop;
3. Return-air temperature sensor with high discharge temperature shutdown;
4. Indoor coil freeze protection.
5. Integral setback control;
6. Automatic airsweep control.
7. Fan Only and Dehumidification modes providing room air circulation when no cooling is required;
8. Continuous diagnostic checks of unit operation indicating malfunctions via error messages displayed at the control panel;
9. User-selectable high, medium, low, or automatic fan speed control during all operating modes;
10. Compressor short cycle delay.

B. Unit Controls:

1. On/Off button.
2. Increase/Decrease Set Temperature buttons.
3. Heat/Auto/Cool/Dry/Fan mode selector.
4. Timer Menu button.
5. Timer On/Off button,
7. Fan Speed selector.
8. Vane Position selector.
9. Louver Swing button.
10. Ventilation button.
11. Test Run button.
12. Check Mode button.

C. Display Parameters:

1. Set Temperature.
2. Room Temperature.
3. Pipe Temperatures (liquid, discharge, indoor and outdoor).
4. Compressor Operating Conditions (running current, frequency, input voltage, on/off status, and operating time)
5. LEV opening pulses, sub cooling and discharge super heat.
PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify concrete pads for condensing units are ready for unit installation.

3.2 INSTALLATION - INDOOR UNITS

A. Install indoor units as indicated on Drawings in accordance with manufacturer’s instructions.
B. Install condensate piping from pump to building drainage system. Refer to Section 15150.
C. Install components furnished loose for field mounting.
D. Install connection to electrical power wiring in accordance with Division 16. Provide disconnecting means in accordance with code.

3.3 INSTALLATION - CONDENSING UNITS

A. Install condensing units on concrete housekeeping pads and vibration isolators. Refer to Section 15070.
B. Install refrigerant piping from indoor units to condensing units. Install refrigerant specialties furnished with units. Refer to Section 15184.
C. Evacuate refrigerant piping and install initial charge of refrigerant.
D. Install electrical devices furnished loose for field mounting.
E. Install control wiring between air handling units, condensing units, and field installed accessories.
F. Install connection to electrical power wiring in accordance with Division 16. Provide disconnecting means in accordance with code.

3.4 MANUFACTURER’S FIELD SERVICES

A. Furnish initial start-up and shutdown during first year of operation, including routine servicing and checkout.

3.5 CLEANING

A. Vacuum clean coils and inside of unit cabinets.
B. Install new filters in units at Substantial Completion.
3.6 DEMONSTRATION

A. Demonstrate air handling unit operation and maintenance.

B. Demonstrate starting, maintenance, and operation of condensing unit including low ambient temperature operation.

C. Furnish services of manufacturer's technical representative for one 8-hour day to instruct Owner's personnel in operation and maintenance of units. Schedule training with Construction Manager, and provide at least 7 days notice in advance of training date.

3.7 PROTECTION OF FINISHED WORK

A. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item DIVISION 15.

END OF SECTION
SECTION 15940

SEQUENCE OF OPERATION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes sequence of operation for:
   1. Air conditioning units.

B. Related Sections:
   1. Section 15739 - Split System Air Conditioning Units.
   2. Section 15950 - Testing, Adjusting and Balancing.

1.2 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Shop Drawings: Indicate mechanical system controlled and control system components.
   1. Label with settings, adjustable range of control and limits. Submit written description of control sequence.
   2. Submit flow diagrams for each control system, graphically depicting control logic.

1.3 CLOSEOUT SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Project Record Documents: Record actual locations of components and set points of controls, including changes to sequences made after submission of shop drawings.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 SPLIT SYSTEM AIR CONDITIONING UNITS

A. Microprocessor based wall-mounted thermostat set at 72 degrees F to maintain constant space temperature. Refer to Section 15739.
PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

   A. Measurement: The work of this section shall not be measured.

   B. Payment: The cost of this section shall be included in the lump sum bid item HVAC SYSTEMS.

END OF SECTION
SECTION 15950
TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Testing adjusting, and balancing of HVAC systems.
   2. Measurement of final operating condition of HVAC systems.

B. Related Sections:
   1. Section 15940 - Sequence of Operation: Sequences of operation for HVAC equipment.

1.2 REFERENCES

A. Associated Air Balance Council:

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

C. Natural Environmental Balancing Bureau:
   1. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

1.3 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Prior to commencing Work, submit proof of latest calibration date of each instrument.

C. Test Reports: Indicate data on AABC MN-1 National Standards for Total System Balance forms, forms prepared following ASHRAE 111, or NEBB Report forms.

D. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

E. Prior to commencing Work, submit report forms or outlines indicating adjusting, balancing, and equipment data required. Include detailed procedures, agenda, and sample report forms.
F. Submit draft copies of report for review prior to final acceptance of Project.

G. Furnish reports in soft cover, letter size, 3-ring binder manuals, complete with table of contents 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.

1.4 CLOSEOUT SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Project Record Documents: Record actual locations of flow measuring stations, balancing valves and rough settings.

C. Operation and Maintenance Data: Furnish final copy of testing, adjusting, and balancing report inclusion in operating and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with AABC MN-1 National Standards for Field Measurement and Instrumentation, Total System Balance; ASHRAE 111; or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

B. Maintain one copy of each document on site.

C. Prior to commencing Work, calibrate each instrument to be used. Upon completing Work, recalibrate each instrument to assure reliability.

1.6 QUALIFICATIONS

A. Agency: Company specializing in testing, adjusting, and balancing of systems specified in this section with minimum three years documented experience.

B. Perform Work under supervision of AABC Certified Test and Balance Engineer; NEBB Certified Testing, Balancing and Adjusting Supervisor; or registered professional engineer experienced in performance of this Work and licensed in State of New Jersey.

1.7 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.8 SEQUENCING

A. Sequence balancing between completion of systems tested and Date of Substantial Completion.
1.9 SCHEDULING

A. Schedule and provide assistance in final adjustment and test of life safety, smoke evacuation, and/or smoke control systems with NJDCA Subcode Inspector.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify systems are complete and operable before commencing work. Verify the following:
   1. Systems are started and operating in 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. Fans are rotating correctly.
   6. Air coil fins are cleaned and combed.

3.2 PREPARATION

A. Furnish instruments required for testing, adjusting, and balancing operations.

B. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

3.3 INSTALLATION TOLERANCES

A. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.4 ADJUSTING

A. Verify recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.
D. Report defects and deficiencies noted during performance of services, preventing system balance.

E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

F. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Construction Manager.

G. Check and adjust systems approximately six months after final acceptance and submit report.

3.5 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to obtain required or design supply, return, and exhaust air quantities.

B. Measure air quantity at outlet.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the allowance for TESTING, ADJUSTING AND BALANCING.

END OF SECTION
SECTION 16000
BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes general requirements for all electrical work. The extent of electrical work is as indicated on the Contract drawings and individual specification sections, whether included in Division 16 – Electrical, or incorporated by reference.

B. Schedule and stage electrical work to follow the overall Contract phasing plans. Furnish all labor, supervision, materials, tools and equipment necessary to coordinate and install the electrical work as indicated on Contract drawings, or herein specified.

C. Provide and install electrical power, lighting, control, alarm, and communication systems equipment and components thereof, including, but not limited to, the following, where applicable to this project:
   1. Service entrance.
   2. Branch circuits.
   3. Outlets and switches.
   4. Power wiring of electrical service connections and other equipment, including electrified hardware, etc.
   5. Hangers, anchors, cutting, patching, pass through, fire cutoff, smoke sealed and watertight sleeves, bases, chases, supports for fixtures, and all other electrical equipment in association therewith.
   6. Lighting fixtures, wiring and lamps.
   7. Temporary power and lighting for construction of all trades.
   8. All conduits and wiring, boxes and enclosures.
   9. Connections to mechanical equipment served by electrical power.

1.2 DRAWINGS AND SPECIFICATIONS

A. Drawings are generally diagrammatic and indicative of the work; follow as closely as practicable. Neither the Drawings nor these Specifications are intended to show or describe every small construction detail. Complete the work in such manner that the various equipment and systems specified will function, operate and perform in the true intent and meaning of these Specifications.

B. Locations of equipment, fixtures, conduit and wiring shown are only approximately correct and are subject to modifications caused by structural conditions and equipment of other trades. No extra charges are allowed for such modifications. Obtain written approval for any changes contemplated before installation of the work.
C. Because of the small scale of Drawings, offsets that may be required to clear structural work or existing conditions may not be shown. Provide necessary offsets as required to complete the installation.

1.3 ELECTRICAL SUBMITTALS

A. Refer to the General Provisions for Construction for submittal definitions, requirements, and procedures. Review of submittals is only for general conformance with the overall design concept, and general compliance with the standards and requirements specified herein.

B. Submittal of Shop Drawings, Product Data, and Samples will only be accepted when submitted by the Contractor. Data received directly from subcontractors and material suppliers will not be processed.

C. Perform field inspection of the existing electrical system prior to the initiation of any work. Include all electrical wiring that is relevant to the work specified herein. Diagram and submit all findings to NJ TRANSIT.

D. Submit product data for specified materials and equipment, regardless of whether specific manufacturers and models or only general design requirements and reference standards are indicated. In addition, submit drawings of any other materials or equipment requiring filing or coordination with other trades, as well as any operating equipment specified elsewhere.

1.4 PERMITS, FEES, CODES AND STANDARDS

A. Complete Work in conformance to the NJ Uniform Construction Code (NJUCC), its adopted subcodes, and their referenced standards, whether or not specified herein, including, but not limited to, the following:
   1. NJUCC Electrical Subcode (NFPA 70-2008, as amended).
   2. Listing requirements of Underwriter's Laboratories, ETL/Intertek, Factory Mutual, Warnock-Hersey, or other testing firm acceptable to the authority having jurisdiction.

B. Complete construction permit application form and applicable subcode forms as required by the NJ Department of Community Affairs (NJDCA), Bureau of Construction Project Review, State Buildings Unit. Submit forms to NJDCA through NJ TRANSIT. NJ TRANSIT will pay for construction permit fees.

C. Ensure all work is inspected and approved by the NJDCA. Request periodic rough-in and final inspections as necessary in accordance with NJDCA requirements.
D. Do not request Acceptance for Substantial Completion for electrical work until final inspection has been made and Certificate of Approval or Occupancy has been issued by the NJDCA.

E. Obtain markouts, permits and approvals from utility companies, and any other authorities having jurisdiction. Pay any fees required by the utility company.

F. Specific requirements of the NJUCC and its adopted subcodes supersede conflicting requirements of other documents specified herein, except that the Contract documents shall take precedence whenever they require materials, workmanship, arrangements or construction of higher standard or larger size than is required by codes and regulations.

1.5 TESTING LABORATORY CERTIFICATION

A. Ensure that all electrical equipment bears approval label from Underwriter’s Laboratories, ETL/Intertek, Factory Mutual, Warnock-Hersey, or other testing firm acceptable to the authority having jurisdiction where certification or listing is furnished for the particular type of equipment.

1.6 QUALITY ASSURANCE

A. Provide, at the appropriate time or as directed, the services of a competent, factory-trained representative of the particular manufacturer of the equipment or item involved, to inspect, adjust, and place in proper operating condition any and all such items of manufacturer. No additional compensation will be allowed the Contractor for such services.

B. Demonstrate the proper functioning of all detection, alarm and signaling equipment; equipment supplied by other trades; and lighting fixtures and lamps. Test wiring for proper connections, short circuits, and grounding using suitable testing instruments. Lubricate all rotating equipment and check direction of rotation of all motors.

1.7 WARRANTY

A. Refer to the General Provisions for Construction for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.

B. Compile and assemble the warranties specified into a separated set of vinyl covered, 3-ring binders, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond; duration of warranty or bond; and names, addresses and telephone numbers and procedures for filing a claim and obtaining warranty services.
1.8 MANUFACTURER’S OPERATING INSTRUCTIONS

A. Refer to the General Provisions for Construction for procedures and submittal requirements for manufacturer’s installation, operating and maintenance instructions. Refer to individual specification sections for equipment specific requirements.

B. Provide, for each item of equipment or apparatus furnished, printed instruction manuals obtained from the manufacturer covering the proper operation, care, lubrication, cleaning, servicing, adjusting and parts manuals, of the items involved, together with special safety instructions. Arrange for manufacturer’s representative to instruct NJ TRANSIT personnel, who will operate the equipment, in all such details.

C. Provide charts and diagrams giving the number, location and function of each item, and including the following:
   1. Manufacturer;
   2. Product name;
   3. Model number;
   4. Serial number;
   5. Capacity;
   6. Operating and power characteristics;
   7. Labels of tested compliances; and,
   8. Similar essential data

D. Locate nameplates in an accessible and easily visible location.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.

B. Accept and store equipment and materials on site and inspect for damage, unless off-site storage is authorized in writing. Protect from corrosion and entrance of debris by storing above grade. Provide appropriate covering to protect stored equipment and materials from damage and exposure to weather.

C. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged; and protected to prevent damage during shipment, storage and handling.

D. Coordinate deliveries of materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

1.10 PROJECT RECORD DOCUMENTS

A. Submit under requirements of General Provisions for Construction.
B. Mark “AS-BUILT” drawings and specifications to indicate revisions to all equipment; approved substitutions and actual equipment and materials used; actual equipment locations; electrical circuitry; Change Orders; and, concealed control system devices.

C. Mark “AS-BUILT” specifications to indicate approved substitutions; Change Orders; actual equipment and materials used.

1.11 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Verify routing and termination locations of circuits prior to rough-in.

C. Circuit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

1.12 SCHEDULING

A. Schedule work to expedite collection of data to ensure completion of study for final approval of distribution equipment shop drawings prior to release of equipment for manufacturing.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. As specified in individual specification sections.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. Coordinate work with all trades involved. Follow overall Contract phasing plans.

B. Verify all dimensions by field measurements. Verify circuiting arrangements are as shown on Drawings.

C. Arrange for chases, slots, and openings to allow for electrical installations.

D. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

E. Sequence, coordinate and integrate installations of electrical materials and equipment for efficient flow of the work.
F. Coordinate the cutting and patching of components to accommodate the installation of electrical equipment and materials. Perform patching using trade most proficient in repairing the particular materials and/or surfaces damaged.

G. Where mounting heights are not detailed or dimensioned, install electrical services and overhead equipment to provide the maximum headroom possible.

H. Install electrical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

I. Coordinate the installation of electrical materials and equipment with structural components and mechanical systems.

J. When two or more items of same material or equipment are required, provide products of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, wire, conduit, fittings, sheet metal, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in work, except as otherwise indicated.

K. Provide products that are compatible within systems and other connected items.

3.2 COOPERATION WITH OTHER TRADES

A. Cooperate with all other trades whose work might in any way affect Electrical installations, and arrange work within all practical limits so that there will be no interference with the work of the various trades.

B. Where the work is concealed, provide advance planning as necessary to prevent projections beyond finished surfaces.

C. Assume full responsibility for damage caused by Electrical work to the work of other trades during the execution of this Contract.

3.3 CIRCUIT LAYOUT

A. Responsibility for accurate conduit and wiring layout and changes to the layout rests with the Contractor. Changes to the layout to accommodate conditions arising during construction shall be made without additional compensation.
   1. Run conduit and wiring straight and direct, neatly and evenly spaced, forming right angles or parallel lines with building walls and other conduit.
   2. Keep horizontal runs high and close to walls, except where concealed in construction.
   3. Keep offsets close to underside of beams, joists and similar construction.
   4. Install all conduit with necessary offsets as encountered to suit structural and other building conditions.
   5. Conceal work in finished spaces where feasible, and where shown.
B. Lock out all circuits with tags until tested, and then lock out again until all construction activities are completed and normal service begins.

C. When circuiting is complete, measure steady state load currents for each branch circuit feeder, and rearrange circuits in each panelboard to balance phase loads to within 20-percent of each other. Maintain proper phasing for multi-wire branch circuits.

3.4 PAINTING

A. Thoroughly clean all work and leave same in a neat and workmanlike condition for the application of field painting.

B. If factory finishes, including prime coats on equipment, are marred, worn, rusted, or otherwise defaced, repaint same with two coats of enamel of matching color.

C. Apply two coats of rust inhibiting enamel paint to all concealed supports fabricated of ferrous metal that are not otherwise protected against corrosion.

D. Unless otherwise noted, paint all exposed conduits to match finish of adjacent wall or structure. Refer to the requirements of Section 16075.

3.5 ELIMINATION OF NOISE AND VIBRATION

A. Ensure all equipment and accessories operate without objectionable noise and vibration.

B. Should operation of any one or more of the systems produce noise or vibration which is objectionable, make changes in equipment and do all work necessary to eliminate the objectionable noise or vibration.

3.6 FINAL TESTS

A. Prior to requesting Acceptance for Substantial Completion for electrical work, successfully perform all tests specified, deemed necessary to show proper execution of the work, and/or required by code in the presence of the Construction Manager, Engineer, and the appropriate NJDCA Subcode Inspector. Submit scheduling of all testing procedures for approval in advance.

B. Perform all tests and inspections of equipment, material, and wiring to determine whether all provisions of these Specifications and Drawings have been fulfilled. Test wiring for proper connections, short circuit, and grounds, using suitable testing instruments. Lubricate all rotating equipment and check direction of rotation of all motors.

C. Where equipment supplied by other trades is energized, controlled or otherwise made operative by electric wiring systems, conduct testing which will prove proper functional performance specifically by the trade responsible for that equipment.
D. Testing all lighting fixtures and lamps to demonstrate proper functioning. Refer to Sections 16510, 16520 and 16530, as applicable.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item ELECTRICAL.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rod electrodes.
   2. Wire.
   3. Access wells.
   4. Clamps and mechanical connectors.
   5. Exothermic connections.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:
   2. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.

B. International Electrical Testing Association:

C. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code.

D. Telecommunications Industry Association/Electronic Industries Alliance:
   1. TIA/EIA-607 – Commercial Building Grounding and Bonding Requirements for Telecommunications.

1.3 SYSTEM DESCRIPTION

A. Grounding systems use the following elements as grounding electrodes:
   1. Metal underground water pipe.
   2. Metal building frame.
   3. Concrete-encased electrode.
   4. Rod electrode.
   5. Plate electrode.

1.4 PERFORMANCE REQUIREMENTS

A. Building Grounding System Resistance: 25 ohms maximum, unless otherwise noted.
1.5 SUBMITTALS
A. Submit in accordance with General Provisions for Construction.
B. Product Data: Submit data on grounding electrodes and connections.
C. Test Reports: Indicate overall resistance to ground and resistance of each electrode, as well as test results obtained from test procedures outlined in Article 3.7 below.
D. Manufacturer's Installation Instructions: Submit for active electrodes.
E. Manufacturer's Certificate: Certify active electrodes meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS
A. Submit in accordance with General Provisions for Construction.
B. Project Record Documents: Record actual locations of components and grounding electrodes.

1.7 QUALITY ASSURANCE
A. Provide building grounding system materials conforming to requirements of NFPA-70 and IEEE 142.
B. Furnish products listed and approved by Underwriter's Laboratories, ETL Testing Laboratories, Factory Mutual, Warnock-Hersey, or other testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.8 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
B. Installer: Licensed electrical contractor specializing in performing work of this section. Installers of active electrodes shall be approved by manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.
B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

D. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

PART 2 PRODUCTS

2.1 ROD ELECTRODES

A. Manufacturers:
   3. Southern Grounding Products, Model C-5810.
   10. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Product Description:
   1. Material: Copper-clad steel or copper.
   2. Diameter: 3/4-inch.
   3. Length: 10 feet.

2.2 WIRE

A. Foundation Electrodes: Sizes as indicated on Drawings, Copper, minimum #4 AWG.

B. Grounding Electrode Conductor: Copper, sizes as indicated on Drawings, minimum #6 AWG.

C. Equipment Grounding and Bonding Conductors: Copper, sized in accordance with NFPA-70 unless otherwise noted on Drawings.

D. Telecommunications Bonding Backbone (TBB): Copper, sizes in accordance with TIA/EIA-607, minimum #6 AWG.

2.3 ACCESS WELLS

A. Manufacturers:
   2. Erico, Inc., “Eritech” Model T416B.
4. Harger Lightning & Grounding Co., Model 358PS.
7. ALLTEC Corp., Model FL8T “FiberLyte”.
8. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Product Description: Minimum 8-inch diameter x 12-inch long cylinder, with cover and legend "GROUND" embossed on face.

2.4 GROUND ROD CLAMPS

A. Manufacturers:
1. Blackburn/Thomas & Betts Corp., Model GG58H.
3. Southern Grounding Products, Model WB58H.
8. Independent Protection Co., Model 51A.
10. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Description: Heavy duty bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

2.5 MECHANICAL CONNECTORS

A. Manufacturers:
1. Blackburn/Thomas & Betts Corp.
2. Erico, Inc.
3. Southern Grounding Products.
4. Advanced Lightning Technology, Inc.
5. Harger Lightning & Grounding Co.
7. Heary Brothers Lightning Protection Co., Inc.
8. Independent Protection Co.
9. ALLTEC Corp.
10. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Description: Heavy duty bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.
2.6 EXOTHERMIC CONNECTIONS

A. Manufacturers:
1. Thomas & Betts Corp., “FurseWeld”.
2. Erico, Inc., “CadWeld”.
3. Continental Industries, “thermOweld”.
6. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify final backfill and compaction has been completed before driving rod electrodes.

3.2 PREPARATION

A. Remove paint, rust, mill oils, and other surface contaminants at connection points.

3.3 EXISTING WORK

A. Modify existing grounding system, including grounding and bonding of all metal objects on station platform, to maintain continuity and accommodate phased renovations.

B. Extend existing grounding system as necessary using materials and methods compatible with existing electrical installations, or as specified.

C. Provide temporary grounding and bonding of metal objects on temporary platforms using procedure indicated below for permanent platform structures.

3.4 POWER SYSTEMS GROUNDING

A. Permanently ground entire light and power system in accordance with NFPA-70, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.
B. Install grounding systems in accordance with NFPA 70 and IEEE 142.

C. Install grounding electrode as follows:
   1. Where available, install continuous grounding using underground cold water system and building steel as grounding electrode.
   2. Install #4 AWG bare copper wire in foundation footing as indicated on Drawings.
   3. Where water piping, building steel and/or foundation electrodes are not available, install made electrode by means of driven rods or buried electrodes at locations indicated on Drawings. Install additional rod electrodes as necessary to achieve specified resistance to ground.
   4. Install grounding well pipe with cover at each rod location. Install top of well pipes flush with finished grade.

D. Install equipment grounding system from grounding bus of main distribution panel to ground bus of subpanel(s), grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment. Ground conduits by means of grounding bushings on terminations at panelboards with bonding jumper to grounding bus.

E. Provide separate, insulated conductor within feeder and branch circuit raceways. Size grounding conductors in accordance with NFPA-70. Terminate each end on suitable lug, bus, or bushing.

F. Permanently attach equipment and grounding conductors prior to energizing equipment.

3.5 GROUNDING OF PLATFORM STRUCTURES

A. Bond together all metal objects on station platforms, including but not limited to canopy structure and roofing, railings, metal storefronts, light standards, signs, display cases, etc.; bond to ground as indicated on drawings using #4/0 AWG bare copper bonding conductor and exothermic weld or mechanical connectors.

B. Bond together each metallic raceway, pipe, duct and other metal objects located under platforms or on canopy structures. Install #4/0 AWG bare copper bonding conductor and exothermic weld or mechanical connectors.

C. Bond together reinforcing steel and metal accessories as indicated on drawings.

D. Do not bond platform structure grounding to catenary structure or electric traction grounding system.

3.6 GROUNDING OF OTHER SYSTEM

A. Bond together metal siding not attached to grounded structure; bond to ground.

B. Bond together reinforcing steel and metal accessories as indicated on drawings.
3.7 FIELD QUALITY CONTROL

A. Inspect and test grounding system in accordance with NETA ATS, except Section 4. Perform inspections and tests listed in NETA ATS, Section 7.13.

B. Perform continuity testing and ground resistance testing in accordance with IEEE 142.

C. When improper grounding is found on receptacles, check receptacles in entire project and correct. Perform retest.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment:
   1. The cost of building grounding systems shall be included in the lump sum bid item ELECTRICAL.

END OF SECTION
SECTION 16070
ELECTRICAL HANGERS AND SUPPORTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Conduit supports.
   2. Formed steel channel.
   4. Sleeves.
   5. Mechanical sleeve seals.
   6. Firestopping relating to electrical work.
   7. Firestopping accessories.
   8. Equipment bases and supports.

B. Related Sections:
   1. Section 03300 - Cast-In-Place Concrete: Product requirements for concrete for placement by this section.

1.2 REFERENCES

A. American Society for Testing and Materials:
   2. ASTM A 446 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
   3. ASTM A 525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
   4. ASTM A 570 - Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.

B. National Electrical Contractors Association:
   1. NECA - Standard of Installation.

C. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code.

D. Underwriters Laboratories Inc.:
   1. UL - Fire Resistance Directory.
1.3 PERFORMANCE REQUIREMENTS

A. Load Capacity: Design trapeze hangers carry required load plus an additional 25 percent spare capacity for future expansion.

B. Firestopping: ASTM E814 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.

C. Surface Burning: ASTM E84 with maximum flame spread / smoke developed rating of 25/450.

1.4 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.

C. Product Data:
   1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
   2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

D. Firestopping: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

E. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports.

F. Manufacturer's Installation Instructions:
   1. Hangers and Supports: Submit special procedures and assembly of components.
   2. Firestopping: Submit preparation and installation instructions.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.
1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.

B. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

C. Provide ventilation in areas to receive solvent cured materials.

PART 2 PRODUCTS

2.1 CONDUIT SUPPORTS

A. Manufacturers:
   1. Erico, Inc.
   2. Appleton Electric.
   4. Kindorf/Thomas & Betts Corp.
   5. Allied Tube and Conduit Corp.
   6. GS Metals Corp.
   7. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

C. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

D. Conduit Clamps for Trapeze Hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

E. Conduit Clamps - General Purpose: One-hole malleable iron for surface mounted conduits.

F. Cable Ties: High strength nylon temperature rated to 185 degrees F; self-locking.

2.2 FORMED STEEL CHANNEL

A. Manufacturers:
   2. Kindorf/Thomas & Betts Corp.
   3. Unistrut Corp.
   5. GS Metals Corp., “Globe-Strut.”
   6. Versabar Corp.
7. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Product Description: ASTM A446/ASTM A525 zinc-coated or ASTM A570 painted steel for interior applications; ASTM A123 galvanized steel for exterior applications, with holes 1-1/2 inches on center.

2.3 INSERTS

A. Manufacturers:
1. B-Line Systems, Inc.
2. Unistrut Corp.
4. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Spot Inserts: Galvanized steel or malleable iron, with threaded connection or channel slot for hanger rods and insert nuts; lugs for attaching to forms; size inserts to suit threaded hanger rods.

C. Continuous Insert Channels: Minimum 12 gauge galvanized steel, with channel slot for hanger rods and insert nuts; welded or punched anchors; anchor end caps; size inserts to suit threaded hanger rods.

2.4 EXPANSION ANCHORS

A. Manufacturers:
2. ITW Ramset/Red Head, “Trubolt” Model.
5. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Description: Expanding wedge type with zinc-plated carbon steel stud, wedge, nut and washer, sized for load intended.

2.5 SLEEVES

A. Manufacturers:
1. CSD Sealing Systems, “RISE” or “RISWAT”.
4. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Sleeves for Conduit/Cable Through Non-Fire-Rated Floors: 18-gauge thick galvanized steel.
C. Sleeves for Conduit/Cable Through Non-Fire-Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18-gauge thick galvanized steel.

D. Sleeves for Conduit/Cable Through Fire-Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

E. Fire-Stopping Insulation: Glass fiber type, non-combustible.

2.6 MECHANICAL SLEEVE SEALS

A. Manufacturers:
1. ProSet Systems, Inc.
2. CSD Sealing Systems.
3. Link-Seal Div., Thunderline Corp.
5. BWM Company.
6. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.7 FIRESTOPPING

A. Manufacturers:
1. 3M Corp., “Fire Barrier” CP 25WB or 2000N/S.
3. Hilti Corp., “FS-One”.
7. AD Fire Protection Systems, “FireBarrier”.
8. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
1. Silicone Firestoppping Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.

6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.

7. Firestop Pillows: Formed mineral fiber pillows.

C. Color: As selected from manufacturer’s full range of colors to match adjacent finish.

2.8 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Dam Material: As recommended by firestopping product manufacturer. Use mineral fiber where manufacturer’s instructions are silent.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. General:
   1. Furnish NRTL listed products.
   2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:
   1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
   2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive firestopping.
3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing/damming materials to arrest liquid material leakage.

D. Do not drill or cut structural members without written permission from Architect/Engineer.

3.3 INSTALLATION - HANGERS AND SUPPORTS

A. Anchors and Fasteners:
   1. Concrete Structural Elements: Use precast/preset inserts or expansion anchors. Do not use powder-actuated fasteners.
   2. Steel Structural Elements: Use beam clamps, steel ramset fasteners, and welded fasteners. Do not use spring steel clips and clamps.
   3. Concrete Surfaces: Use expansion anchors.
   4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
   5. Solid Masonry Walls: Use expansion anchors or preset inserts.
   7. Wood Elements: Provide wood screws.

B. Inserts:
   1. Install inserts for placement in concrete forms.
   2. Install 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 recessed into and grouted flush with slab.

C. Install conduit and raceway support and spacing in accordance with NFPA-70.

D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

E. Install multiple conduit runs on common hangers.

F. Supports:
   1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
2. Install surface mounted cabinets and panelboards with minimum of four anchors.
3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.
4. Support vertical conduit at every floor.

3.4 INSTALLATION - FIRESTOPPING

A. Firestop interruptions to fire rated assemblies, materials, and components.

B. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

C. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

D. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.

E. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials. Place intumescent coating in sufficient coats to achieve rating required.

F. Fire Rated Surface:
   1. Seal openings in floors, walls, partitions, ceilings, and roof openings as follows:
      a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
      b. Size sleeve allowing minimum of 1-inch void between sleeve and building element.
      c. Pack void with backing material.
      d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
   2. Where cables, conduits and wireways penetrate fire rated surfaces, install firestopping product in accordance with manufacturer’s instructions.

G. Non-Rated Surfaces:
   1. Seal opening through non-fire rated walls, partitions, ceilings, and roof openings as follows:
      a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
      b. Size sleeve allowing minimum of 1-inch void between sleeve and building element.
      c. Install type of firestopping material recommended by manufacturer.
2. Install escutcheons, floor plates or ceiling plates where conduit penetrates non-fire rated surfaces in spaces with finished ceilings and where penetration occurs below finished ceiling.

3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.

4. Interior partitions: Seal pipe penetrations at telecommunication rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment. Refer to Section 03300.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members and/or formed steel channel. Brace and fasten with flanges bolted to structure.

3.6 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with adjustable interlocking rubber links.

B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.

C. Set sleeves in position in forms. Provide reinforcing around sleeves.

D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

E. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

F. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

G. Install escutcheons at finished surfaces.

3.7 FIELD QUALITY CONTROL

A. Inspect installed firestopping for compliance with specifications and submitted schedule.
3.8 CLEANING
   A. Clean adjacent surfaces of firestopping materials.

3.9 PROTECTION OF FINISHED WORK
   A. Protect adjacent surfaces from damage by material installation.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT
   A. Measurement: The work of this section shall not be measured.
   B. Payment: The cost of this section shall be included in the lump sum bid item ELECTRICAL.

END OF SECTION
SECTION 16075

ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Nameplates.
   2. Labels.
   3. Wire markers.
   5. Stencils.
   7. Lockout Devices.

1.2 REFERENCES

A. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Product Data:
   1. Submit manufacturer's catalog literature for each product required.
   2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.

C. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

1.4 CLOSEOUT SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

1.5 QUALITY ASSURANCE

A. Provide materials conforming to requirements of NFPA-70.
1.6 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.
B. Accept identification products on site in original containers. Inspect for damage.
C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.8 ENVIRONMENTAL REQUIREMENTS
A. Install labels and nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

PART 2 PRODUCTS

2.1 NAMEPLATES
A. Manufacturers:
   1. Seton Identification Products Co.
   2. Brady Corp.
   3. EMED Co., Inc.
   5. Marking Systems, Inc.
   6. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
B. Product Description: Laminated three-layer plastic with engraved black letters on white contrasting background color; minimum 1/8-inch thick.
C. Letter Size:
   1. 1/8-inch high letters for identifying individual equipment and loads.
   2. 1/4-inch high letters for identifying grouped equipment and loads.
D. Locations:
   1. Each electrical distribution and control equipment enclosures.
   2. Communication systems cabinets.
   3. Individual circuit breakers on main distribution switchboard.
2.2 LABELS

A. Manufacturers:
   1. Seton Identification Products Co.
   2. Brady Corp.
   3. EMED Co., Inc.
   5. Marking Systems, Inc.
   6. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Labels: Embossed adhesive tape, with 3/16-inch white letters on black background.

2.3 WIRE MARKERS

A. Manufacturers:
   1. Panduit Corp.
   2. Brady Corp.
   3. Thomas & Betts Corp.
   4. USA GrafoPlast Wire Markers, Inc.
   5. Ideal Industries, Inc.
   6. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Description: Cloth tape, split sleeve or tubing type wire markers.

C. Legend:
   1. Power and Lighting Circuits: Branch circuit or feeder number.
   2. Control Circuits: Control wire number as indicated on manufacturer’s schematic and interconnection diagrams or shop drawings.

2.4 CONDUIT AND RACEWAY MARKERS

A. Manufacturers:
   1. Seton Identification Products Co.
   2. Brady Corp.
   3. EMED Co., Inc.
   5. Marking Systems, Inc.
   6. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Description: Labels fastened with adhesive:
   1. Electrical System: “XXX VOLTS”; black lettering on orange background.
   2. Fire Alarm System: “FIRE ALARM”; red lettering on white background.
   3. Telephone System: “TELEPHONE”; blue lettering on white background.
2.5 STENCILS

A. Manufacturers:
   1. Seton Identification Products Co.
   2. Brady Corp.
   3. EMED Co., Inc.
   5. Marking Systems, Inc.
   6. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Stencils: With clean cut symbols and letters of following size:
   1. Up to 2 inches Outside Diameter of Raceway: 1/2 inch high letters.
   2. 2-1/2 to 6 inches Outside Diameter of Raceway: 1 inch high letters.

C. Stencil Paint: Semi-gloss enamel, colors conforming to the following:
   1. Black lettering on white background.
   2. White lettering on gray background.
   3. Red lettering on white background.
   4. Blue lettering on white background.

2.6 UNDERGROUND WARNING TAPE

A. Manufacturers:
   1. Seton Identification Products Co.
   2. Brady Corp.
   3. EMED Co., Inc.
   5. Marking Systems, Inc.
   6. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Description: Continuously printed red plastic ribbon tape, with suitable warning legend describing buried electrical lines, manufactured for direct burial service.
   1. 6-inch wide by 4 mil thick tape for buried metallic conduit.
   2. 2-inch wide metallic detection tape for buried non-metallic conduit.

2.7 LOCKOUT DEVICES

A. Lockout Hasps:
   1. Manufacturers:
      a. Seton Identification Products Co.
      b. Brady Corp.
      c. EMED Co., Inc.
      d. Carlton Industries, Inc.
      e. Prinzing Enterprises, Inc.
      f. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
2. Anodized aluminum or reinforced nylon lockable hasps for circuit breakers and safety switches, with warning label.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.
B. Prepare surfaces for painting.

3.2 EXISTING WORK

A. Install identification on existing equipment to remain in accordance with this section.
B. Install identification on unmarked existing equipment.
C. Replace lost nameplates, labels and markers.
D. Re-stencil existing equipment.

3.3 INSTALLATION

A. Install identifying devices after completion of painting.
B. Nameplate Installation:
   1. Install nameplate parallel to equipment lines.
   2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.
   3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.
   4. Secure nameplate to equipment front using screws or adhesive.
   5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.
   6. Install nameplates for the following:
      a. Switchboards and panelboards.
      b. Individual circuit breakers on main distribution switchboard.
      c. Transformers.
      d. Service disconnects.
      e. Safety switches.
      f. Motor controllers.
      g. Contactors and control devices.
      h. Communication systems cabinets.
C. Label Installation:
   1. Install label parallel to equipment lines.
2. Install label for identification of individual control device stations.
3. Install labels for permanent adhesion and seal with clear lacquer.

D. Wire Marker Installation:
1. Install wire marker for each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.
2. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.
3. Install labels at data outlets identifying patch panel and port designation.

E. Conduit and Raceway Marker Installation:
1. Install conduit and raceway markers for each run longer than 6 feet.
2. Marker Spacing: 20 feet on center.
   a. Paint colored band on each conduit longer than 6 feet.
   b. Paint bands 20 feet on center.
   c. Color:
      1) Electrical Volt System: Yellow.
      2) Fire Alarm System: Red.
      3) Telecommunications System: Green.

F. Underground Warning Tape Installation: Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade, directly above buried conduit, raceway, or cable.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item ELECTRICAL.

END OF SECTION
SECTION 26 05 63
TESTING ELECTRICAL

PART 1  GENERAL

1.1  SUMMARY

A.  Section Includes: The work specified in this Section consists of materials to performance test electrical systems and equipment.
   1.  Items Supplied Under This Section:
      a.  Electrical System Testing
      b.  Thermographic Testing
      c.  Ground System Testing
      d.  Insulation Testing
      e.  Equipment Testing
      f.  Performance Test
      g.  Test Procedure
      h.  Test Report

B.  Related Sections:
   1.  Division 1 – General Requirements
   2.  Division 16 Sections, As Applicable

1.2  REFERENCES

A.  Applicable Documents and Testing Requirements of:
   1.  National Fire Protection Association (NFPA), as applicable, including:
        a.  NFPA 70 - National Electrical Code (NEC).
   2.  National Electrical Testing Association:
        a.  ATS-1 Acceptance Testing.

1.3  SUBMITTALS

A.  Submit documentation as required by this Section of the Contract to the Design Engineer in strict accordance with the provisions of Section 16000 for review, comments and subsequent approval.

B.  Submission to include the following:
   1.  Field inspection report as required for each item of material and/or equipment outlined herein.
   2.  Manufacturer’s directions for use of ground megger with proposed method indicated.

C.  Test Reports:
   1.  Each test report prepared by the respective testing firm(s) comply, where applicable, to all stipulations specified in Section 16000 for Operation, Maintenance and Installation Manuals with reference to preparation, paper requirements, indexing and binders. Include in each test report the following:
       a.  Summary of project.
       b.  Description of equipment tested.
c. Description of test.
d. Test results.
e. Conclusions and recommendations.
f. Appendix, including appropriate test forms.
g. Identification of test equipment used.
h. Signature of responsible test organization authority.
i. Furnish five copies of each completed report to the Design Electrical Engineer no later than 30 days after completion of each test. Assemble and certify the testing firm each final test report, which must be submitted to the Design Engineer for review, comments and subsequent approval.

1.4 QUALITY ASSURANCE

A. Qualifications of Testing Laboratory: Select an independent nationally recognized testing laboratory that is independent from electrical contractor that either is a member of The International Electrical Testing Association or meets the following qualifications:
   1. Is nationally recognized as an electrical testing laboratory.
   2. Has been regularly engaged in the testing of electrical systems and equipment for at least 5 years.
   3. Is independent from the electrical contractor, the Owner, the Engineer and all other contractors on the job.
   4. Has at least one Professional Engineer on staff that is licensed in the State where the project site is located.
   5. Derives more than 80 percent of its income from electrical testing.
   6. Owns or leases sufficient calibrated equipment to do the testing required.
   7. Has a means to trace all test instrument calibration to The National Bureau of Standards.

B. Membership in the International Electrical Testing Association (NETA) shall be considered evidence of meeting items A. 1. through and including A. 5.

C. Testing shall be done under the supervision of a technician certified by International Electrical Testing Association or by technicians that are both certified by the National Society of Professional Engineers and experienced in electrical testing with 5 years of testing experience.

D. The testing laboratory shall supervise or perform all testing of equipment and oversee setting of all circuit breakers and calibration of all instruments.

E. The testing firm used must be approved by the Engineer.

F. Include the cost of such tests in the Contractors Bid Price for the applicable bid item.

1.5 GENERAL REQUIREMENTS

A. Field Inspection:
   1. This Contractor is responsible for a complete inspection of all equipment, prior to testing and energizing to ascertain that it is free from any damage, scratches, or missing components and that all power connections are correct, and that they are tight in conformance with recommended standard practice. The inspection is
to also include a check of control wiring, terminal connections and all bolts and nuts.

2. Perform field inspection by this Contractor during a time when the Field Engineer and the Design Engineer are present to witness each inspection and its performance.

3. Correct any deficiencies found during the inspection by this Contractor prior to the energizing and testing of the equipment.

1.6 SCHEDULING

A. Schedule all testing with work of other contractors to ensure an orderly sequence of startup and completion of work.

PART 2 PRODUCTS
NOT USED

PART 3 EXECUTION

3.1 ELECTRICAL INSPECTIONS AND TESTS

A. Perform, supervise, and furnish all test equipment needed to perform tests and provide safety measures, procedures and equipment required for each test.

B. Schedule all testing with the Engineer. Perform testing in the presence of the Engineer except when the Engineer approves in writing conducting a specific test without the Engineer's presence.

C. Notify all involved parties including the Engineer prior to tests, advising them of the test to be performed and the scheduled date and time.

D. Coordinate the tests with others involved.

E. Prepare written test procedures and forms used in the test reports and submit for approval prior to commencement of testing.

F. Include in each test report the following information:

2. Date of test.
3. Equipment, system or cable identification.
4. Type of test.
5. Description of test instrument and date of latest calibration.
6. Section of specification defining test along with description of test and evaluations as reported by the testing company.
7. Test results (correct all readings at 20 degrees C).
8. Signature of person supervising test.
9. Signature of Contractor.
10. Space for Engineer's signature.
G. Refer to individual tests and inspections hereinafter specified for any additional or specified requirements.

H. Test Instrument Calibration:
1. The testing firm is to have a calibration program, which assures that all applicable test instrumentation are maintained within rated accuracy.
2. The accuracy is to be directly traceable to the National Bureau of Standards.
3. Instruments are to be calibrated in accordance with the following frequency schedule.
   a. Field Instruments: Analog - 6 months maximum
      Digital - 12 months maximum
   b. Laboratory Instruments: 12 months
   c. Leased specialty equipment: 12 months
4. Make dated calibration labels visible on all test equipment.
5. Keep records up-to-date, which show date and results of instruments calibrated or tested.
6. Maintain an up-to-date instrument calibration instruction and procedure for each test instrument.
7. Calibrating standard is to be of higher accuracy than that of the instrument tested.

I. Safety and Precautions:
1. Safety practices are to include, but are not limited to, the following requirements:
   a. Occupational Safety and Health Act of 1970-OSHA.
   c. Applicable State and Local safety operating procedures.
   d. IETA Safety/Accident Prevention Program.
   e. Owner's safety practices.
   f. National Fire Protection Association - NFPA 70E.
   g. ANSI Z244.1 American National Standards for Personnel Protection.
2. Perform all tests with apparatus de-energized except where otherwise specifically required.
3. The testing firm is to have a designated safety representative on the project to supervise operations with respect to safety.

3.2 TESTING TO BE PERFORMED BY THE CONTRACTOR

A. Continuity Test: Make test for continuity and correctness of wiring and identification on all conductors installed.

B. Wire and Cable:
1. Test all wires and cables sized No. 2 and larger in accordance with NETA ATS 1, paragraph 7.3.1.1 and 7.3.1.2.
2. Perform visual, mechanical, and electrical tests on all No. 4 and No. 6 power cables that operate at voltages exceeding 150 volts to ground in accordance with NETA ATS 1, paragraph 7.3.1.1 and 7.3.1.2.
3. Perform visual, mechanical, and electrical tests on all other wires and cables in accordance with NETA ATS 1, paragraph 7.3.1.1.
4. Replace any wires which have been damaged.
5. Correct causes of all readings which do not meet the acceptable minimum insulation readings are as stated in NETA ATS 1, paragraph 7.3.1.3. Exceed the nominal expected temperatures for the actual load.
6. Retest items requiring correction.

C. Ground Fault Circuit Interrupter (GFCI) Receptacles:
   1. Test all GFCI receptacles as specified in Section 16141.

D. Initial Mechanical Performance Test
   1. Provide on-site electricians and support to the general contractor during the mechanical performance test.
   2. With the personnel of the Owner observing, demonstrate to the satisfaction of the Engineer the mechanical performance of each item of equipment when operated in accordance with the design intent indicated by the Drawings and described in the applicable sections of the Specifications.
   3. Correct all deficiencies and demonstrate that they have been corrected.
   4. Without reliance on Owner's personnel, operate and maintain the equipment in continuous, day to day, 24 hour operation until commencement of the Final Mechanical Performance Test.
   5. During this interim, instruct and train the Owner's personnel in their duties.
   6. Final Mechanical Performance Test: During a 48-hour period.
      a. With equipment in continuous normal operation, under supervision turn operation of the plant over to the personnel of the Owner beginning with the final tests.
      b. Demonstrate that equipment is coordinated and that installation complies with the applicable Drawings and Specifications.
      c. Measure all major feeders, the total power, total power factor, current on all lines, and voltage, phase and phase to ground, and on all phases.
      d. Measure all motors over 5 horsepower, power, power factor and voltage under load.
      e. Correct all deficiencies and demonstrate that they have been corrected.
      f. Owner will pay operating costs for the Final Mechanical Performance Tests.
      g. Test will be considered complete after a continuous 48-hours of satisfactory operation without any failure of equipment.

E. Test Interim:
   1. Contractor's Personnel, without reliance of Owner's Personnel, are to operate and maintain the equipment in continuous, day to day, 24 hour operation except as otherwise approved by the Engineer until commencement of the Final Mechanical Performance Test.
   2. During this interim the Contractor's Personnel are to instruct and train the Owner's Personnel in their duties.

F. Final Mechanical Performance Test: Final Mechanical Performance Test is to cover a 48 hour period while the plant is in continuous, normal operation.
   1. With equipment in continuous, normal operation, the Personnel of the Owner are to assume day to day operation of the equipment under the direct supervision of the Contractor's Personnel beginning with the Final Tests.
   2. Contractor's Personnel are to demonstrate to the satisfaction of the Engineer that equipment is coordinated and that installation complies with the applicable Drawings and Specifications.
3. Performance Tests are to be considered concluded at the end of the forty-eight hour period designated for the tests if the Engineer is satisfied with the test results or should deficiencies be found as a result of said test, then when the deficiencies have been corrected to the satisfaction of the Engineer.

G. Operating Costs: Costs for Final Mechanical Performance Tests: The Owner will pay operating costs for the Final Mechanical Performance Tests except those costs for chemicals required to complete Process Performance Tests and Acceptance Tests, if required on equipment.

3.3 TESTING TO BE PERFORMED BY THE TESTING LABORATORY

A. Select, hire and pay an independent nationally recognized electrical testing laboratory to perform all testing specified in this article. Obtain Owner’s approval of the testing laboratory and the testing laboratory proposed test procedure prior to commencement of any tests.

B. Set all adjustments for all overcurrent protection devices in accordance with the protection and coordination study of Section 16000.

C. Visually and mechanically inspect and electrically test items as scheduled in attached schedule for equipment in attached schedule equipment as listed in attached schedule in using the procedures of NETA ATSI, Section 1. When a test for a particular item is not called out in ATS, test using the procedures in NETA MTSL Section 7.

D. Thermographic Inspection:
   1. Perform thermographic inspection of the electrical equipment and installations as listed below in accordance with NETA ATS 1 section 9, and as detailed below. The following equipment is to be scanned:
      a. Disconnect Switches 100 amp and larger
      b. Individually Mounted Motor Starters Size 1 and larger
      c. Motors 30 HP and larger
   2. Provide report including the following items:
      a. Items scanned
      b. Whether item passed or failed
      c. All items in NETA ATS 1, Paragraph 9.3
      d. The probable cause
      e. Severity of defect
      f. Recommended corrective measures
      g. Video recording of test.
   3. Scan using an infrared camera with video scanner output to a display screen with a range of at least 1 degree C to 75 degrees C with an accuracy of 0.1 degree C and with the following equipment:
      a. One 7 degree telephoto lens
      b. One 20 degree wide angle lens
      c. One 40 degree extra-wide angle lens
   4. Record output of camera during testing on a VHS videotape providing a record of the temperature variations. Record either by order or by digital imprinting the actual equipment being scanned. Turn off recordings during inactive periods or edit tape to eliminate dead periods.
5. Display data on a monitor capable of providing both a gray step mode and color monitor. These capabilities allow distinct temperature levels to be shown in black and white and color on the thermogram.
6. Submit three copies of report and two copies of tape.
7. Include VHS videotape and thermographs of the defective equipment and installations. Also include in report.
8. Submit both copies of the report to the Engineer who will make the determination of corrective measurements.

E. Low Voltage Molded Case Circuit Breaker Tests:
1. Visually and mechanically inspect and electrically test all low voltage circuit breakers in frame sizes rated 100-ampere or more in accordance with NETA ATS 1, paragraph 7.6.1.1.1 and NETA ATS 1, paragraph 7.6.1.1.2.
2. Acceptable values are as stated in NETA ATS 1, paragraph 7.6.1.1.3.

F. Grounding Electrode System Tests:
1. Visually and mechanically inspect and electrically test all made grounding electrode systems in accordance with NETA ATS 1, paragraph 7.13.1 and NETA ATS 1, paragraph 7.13.2. For the point-to-point tests of NETA ATS 1, paragraph 7.13.2.1, measurements are only required for equipment conductors run with services, and feeders and branch circuits rated over 400 amperes.
2. Determine acceptable values as follows:
   a. Main service entrance ground: 5 ohms.
   b. Emergency/standby generator ground grid: 5 ohms.
   c. For continuity tests, determine the acceptable value for the equipment grounding conductor by the following formula:

   \[ R_{\text{EquipGndCond}} \leq 0.1 \times \frac{V_{\text{LineToGnd}}}{I_{\text{OverCurrentProtection}}} \]

   Where the following definitions apply:

   \( R_{\text{EquipGndCond}} \) = The measured resistance of the Equipment Grounding Conductor.

   \( V_{\text{LineToGnd}} \) = The Nominal Line to Ground Voltage of the circuit or feeder.

   \( I_{\text{OverCurrentProtection}} \) = The Trip, or Melting Current of the overcurrent protective device for the circuit.

G. Ground Fault Protection Testing:
1. Visually and mechanically inspect and electrically test all ground fault protection systems in accordance with NETA ATS 1, paragraph 7.14.1. and NETA ATS 1, paragraph 7.14.2.
2. Acceptable test values are as stated in NETA ATS 1, paragraph 7.14.3.

H. AC Motor Testing:
1. Visually and mechanically inspect and electrically test all AC motors rated 10-horsepower or more in accordance with NETA ATS 1, paragraph 7.15.1.1 and NETA ATS 1, paragraph 7.15.1.2.
2. Acceptable test values are as stated in NETA ATS 1, paragraph 7.15.1.4.
3. Immediately report all motors, which fail inspection to the Engineer for correction.
I. Low Voltage Motor Starter Tests:
   1. Visually and mechanically inspect and electrically test all low voltage motor
      starters rated 10-horsepower or more in accordance with NETA ATS 1,
      paragraph 7.16.1.1.1 and NETA ATS 1, paragraph 7.16.1.1.2.
   2. Acceptable values are as stated in NETA ATS 1, paragraph 7.16.1.1.3.

3.4 CORRECTION OF DEFICIENCIES

   A. Report all unacceptable values immediately. Correct all deficiencies found in work of
      this contract and separately report deficiencies in work of items of other contracts.
      1. Retest items requiring correction. Correct or have corrected any remaining
         deficiencies and retest until work is acceptable.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Removal of existing electrical equipment, wiring, and conduit in areas to be remodeled; removal of designated construction; dismantling, cutting and alterations for completion of the Work.
   2. Disposal of materials.
   4. Identification of utilities.
   5. Salvaged items.
   6. Protection of items to remain as indicated on herein or on Drawings.
   7. Relocate existing equipment to accommodate construction.

B. Related Sections:
   1. Section 02225 - Minor Demolition for Remodeling.

1.2 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Shop Drawings: Indicate demolition and removal sequence and location of salvageable items; location and construction of temporary work. Describe demolition removal procedures and schedule.

1.3 CLOSEOUT SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Project Record Documents: Record actual locations of capped utilities, conduits and equipment abandoned in place.

1.4 PRE-DEMOLITION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.5 SCHEDULING

A. Schedule work to coincide with sequence of new construction.

B. Cease operations immediately when structure appears to be in danger and notify Construction Manager. Do not resume operations until directed.
1.6 COORDINATION

A. Conduct demolition to minimize interference with adjacent and/or occupied building areas.

B. Coordinate demolition work with electric utility company.

C. Coordinate and sequence demolition so as not to cause shutdown of operation of surrounding areas.

D. Shut-down Periods:
   1. Coordinate timing of shut-down periods for in-service panels with Construction Manager. Do not shut down any utility without prior written approval.
   2. Keep shut-down period to minimum or use intermittent period as directed by Construction Manager.

E. Identify salvage items in cooperation with Owner.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify wiring and equipment indicated to be demolished serve only abandoned facilities.

C. Verify termination points for demolished services.

3.2 PREPARATION

A. Erect, and maintain temporary safeguards, including warning signs and lights, barricades, and similar measures for protection of the building occupants, Contractor’s employees, and existing improvements to remain.

B. Provide temporary egress signage and emergency lighting as required.
3.3 DEMOLITION

A. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Construction Manager before disturbing existing installation.

B. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit within walls and floors, and patch surfaces.

C. Remove conduit, wire, boxes, and fastening devices to avoid any interference with new installation.

D. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

E. Reconnect equipment being disturbed by renovation work and required for continued service as indicated on Drawings or to nearest available panel.

F. Disconnect or shut off service to areas where electrical work is to be removed. Remove electrical fixtures, equipment, and related switches, outlets, conduit and wiring that are not part of final project.

G. Install temporary wiring and connections to maintain existing systems in service during construction.

H. Remove, relocate, and extend existing installations to accommodate new construction.

I. Repair adjacent construction and finishes damaged during demolition and extension work.

J. Remove exposed abandoned grounding and bonding components, fasteners and supports, and electrical identification components, including abandoned components above accessible ceiling finishes. Cut embedded support elements flush with walls and floors.

K. Clean and repair existing equipment to remain or to be reinstalled.

L. Protect and retain power to existing active equipment remaining.

3.4 EXISTING PANELBOARDS

A. Ring out circuits in existing panel affected by the Work. Where additional circuits are needed, reuse circuits available for reuse. Install new breakers.

B. Tag unused circuits breakers as spare.

C. Where existing circuits are indicated to be reused, use sensing measuring devices to verify circuits feeding Project area or are not in use.
D. Remove existing wire no longer in use from panel to equipment.
E. Provide new updated directories where more than three circuits have been modified or rewired.

3.5 SALVAGE ITEMS
A. Remove and protect items indicated on Drawings to be salvaged and turn over to NJ TRANSIT
B. Items of salvageable value may be removed as work progresses. Transport salvaged items from site as they are removed.

3.6 REUSABLE ELECTRICAL EQUIPMENT
A. Carefully remove equipment, materials, or fixtures that are to be reused.
B. Disconnect, remove, or relocate existing electrical material and equipment interfering with new installation.
C. Relocate existing lighting fixtures as indicated on Drawings. Clean fixtures and re-lamp. Test fixture to see if it is in good working condition before installation at new location.

3.7 CLEANING
A. Keep workplace neat. Remove demolished materials as work progresses and dispose of legally.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT
A. Measurement: The work of this section shall not be measured.
B. Payment: The cost of this section shall be included in the lump sum bid item ELECTRICAL.

END OF SECTION
SECTION 16130

RACEWAY AND BOXES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes conduit, wireways, outlet boxes, pull and junction boxes, and handholes.

B. Related Sections:
   1. Section 16140 - Wiring Devices.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.

B. National Electrical Manufacturers Association:
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
   2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
   3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
   4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
   5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
   6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
   7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SYSTEM DESCRIPTION

A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

B. Underground: Provide plastic coated conduit (PVC coated RGS) or thickwall nonmetallic conduit. Provide nonmetallic boxes or handholes, NEMA 3R.

C. In or Under Slab on Grade: Provide rigid steel conduit, plastic coated conduit (PVC coated RGS) or thickwall nonmetallic conduit. Provide cast or nonmetallic metal boxes.

D. Outdoor Locations, Above Grade: Provide rigid steel conduit. Provide cast metal outlet, pull, and junction boxes, NEMA 3R.
E. In Slab Above Grade: Provide rigid steel conduit, plastic coated conduit (PVC coated RGS) or thickwall nonmetallic conduit. Provide cast or nonmetallic metal boxes, NEMA 3R.

F. Wet and Damp Locations: Provide rigid steel conduit. Provide cast metal outlet, pull, and junction boxes. Provide surface mounting outlet box in all areas, NEMA 3R.

G. Concealed Dry Locations: Provide rigid steel conduit. Provide surface mounting outlet box in all areas. Provide hinged enclosure for large pull boxes, NEMA type 12.


1.4 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 3/4-inch unless otherwise specified.

1.5 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Product Data: Provide for metallic conduit, flexible metal conduit, liquidtight flexible metal conduit, nonmetallic conduit, flexible nonmetallic conduit, surface raceways, wireways, fittings, conduit bodies, outlet, pull and junction boxes, and handholes.

C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 CLOSEOUT SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Project Record Documents:
   1. Record actual routing of conduits larger than 2-inch trade size.
   2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
C. Protect PVC conduit from sunlight.

1.8 COORDINATION

A. Coordinate installation of outlet boxes for equipment connected under Section 16150.

B. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

1.9 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Verify routing and termination locations of conduit prior to rough-in.

C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 PRODUCTS

2.1 METAL CONDUIT

A. Manufacturers:
   1. Wheatland Tube Co.
   2. Allied Tube and Conduit Corp.
   4. Republic Conduit Div./Maverick Tube Corp.
   5. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Rigid Steel Conduit: ANSI C80.1.

C. Intermediate Metal Conduit (IMC): Rigid steel.

D. Fittings and Conduit Bodies: NEMA FB 1; aluminum or steel fittings.

2.2 PVC COATED METAL CONDUIT

A. Manufacturers:
   1. OCAL Division, Thomas & Betts Corp., “OCAL BLUE.”
   2. KorKap Division, RobRoy Industries.
   3. Plasti-Bond Division, RobRoy Industries, “REDH$_2$OT.”
   4. Perma-Cote Division, RobRoy Industries.
   5. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
B. **Product Description:** NEMA RN 1; rigid steel conduit, with 40 mil thick external PVC coating and 2 mil thick internal urethane coating.

C. **Fittings and Conduit Bodies:** NEMA FB 1; steel fittings with external PVC coating to match conduit.

### 2.3 FLEXIBLE METAL CONDUIT

A. **Manufacturers:**
   1. Southwire Co., “Galflex.”
   2. Electri-Flex Co., “Type BR.”
   3. AFC Cable Systems, “Type 55XX.”
   5. International Metal Hose Co., “Type RWS.”
   6. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. **Product Description:** Interlocked steel construction, reduced wall type.

C. **Fittings:** NEMA FB 1.

### 2.4 LIQUIDtight FLEXIBLE METAL CONDUIT

A. **Manufacturers:**
   1. Southwire Co., “Ultratite Type UL.”
   2. Electri-Flex Co., “Liquatite Type LA.”
   3. AFC Cable Systems, “Liquid-Tuff Type LFMC.”
   4. Anamet Electrical, Inc., “Anaconda Sealtite Type UA.”
   5. International Metal Hose Co., “Sealskin Type UALT.”
   6. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. **Product Description:** Interlocked steel construction with PVC jacket.

C. **Fittings:** NEMA FB 1.

### 2.5 NONMETALLIC CONDUIT

A. **Manufacturers:**
   1. Carlon Electrical Products/Lamson & Sessions, “Plus 80.”
   2. Cantex, Inc.
   3. IPEX, Inc., “Scepter”.
   4. Allied Tube and Conduit Corp.
   6. PW Eagle, Inc.
   7. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. **Product Description:** NEMA TC 2; Schedule 80 PVC.
C. Fittings and Conduit Bodies: NEMA TC 3.

2.6 FLEXIBLE NONMETALLIC CONDUIT

A. Manufacturers:
1. Southwire Co., “Ultratite Type NM.”
2. Electri-Flex Co., “Liquatite Type NM.”
3. AFC Cable Systems, “Liquid-Tuff Type LFNC-B.”
4. Anamet Electrical, Inc., “Anaconda Sealtite Type NMUA.”
5. International Metal Hose Co., “Sealskin Type NMUA.”
6. Carlon Electrical Products/Lamson & Sessions, “CarFlex.”
7. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Product Description: Helically wound rigid plastic spiral embedded in PVC wall.

C. Fittings: NEMA FB 1.

2.7 WIREWAY

A. Manufacturers:
1. Hubbell Wiring Devices.
3. Square D.
6. EPI Electrical Enclosures, Inc.
7. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Product Description:
1. Dry, Interior, Finished Locations: NEMA-1 general-purpose type wireway with slip-in connectors, and hinged or screw cover.
2. Dry, Interior, Unfinished Locations: NEMA-12 oiltight and dust-tight type wireway with flanged connectors, screw cover with full gaskets.
3. Damp, Interior Locations: NEMA-12 oiltight and dust-tight type wireway with flanged connectors, hinged cover with full gaskets.
4. Wet, Interior Locations: NEMA-3R raintight type wireway with flanged connectors, hinged cover and full gaskets.
5. Exterior Locations: NEMA-3R raintight type wireway with flanged connectors, hinged cover and full gaskets.

C. Knockouts: Manufacturer's standard, unless otherwise noted.

D. Size: As indicated on Drawings.

E. Fittings: Lay-in type with removable top, bottom, and side; captive screws; provide drip shield for wet applications.
F. Finish: Rust inhibiting primer coating with gray enamel finish.

2.8 OUTLET BOXES

A. Sheet Metal Outlet Boxes:
   1. Manufacturers:
      a. Appleton Electric Co.
      b. Steel City/Thomas & Betts Corp.
      c. RACO, Inc.
      d. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
   2. Description: NEMA OS 1, galvanized steel.
   3. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required.
   4. Concrete Ceiling Boxes: Concrete type.

B. Cast Boxes and Conduit Bodies:
   1. Manufacturers:
      a. Appleton Electric Co.
      b. Thomas & Betts Corp.
      c. Crouse-Hinds/Cooper Industries.
      d. O-Z/Gedney.
      f. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
   2. Description: NEMA FB 1, type FD, aluminum or cast feralloy; with threaded hubs and gasketed cover by box/fitting manufacturer.

C. Nonmetallic Outlet Boxes: NEMA OS 2.

D. Wall Plates for Finished Areas: As specified in Section 16140.

E. Wall Plates for Unfinished Areas: Furnish gasketed cover.

2.9 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes:
   1. Manufacturers:
      a. Appleton Electric Co.
      b. Steel City/Thomas & Betts Corp.
      c. RACO, Inc.
      d. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.
   2. Description: NEMA OS 1, galvanized steel.

B. Hinged Enclosures: As specified in Section 16131.

C. Surface Mounted Cast Metal Box:
   1. Manufacturers:
a. Appleton Electric Co.
b. Thomas & Betts Corp.
c. Crouse-Hinds/Cooper Industries.
d. O-Z/Gedney.
f. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

2. Description: NEMA 250, Type 4; flat-flanged, surface mounted junction box.

3. Material: Galvanized cast iron or cast aluminum.

4. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

D. In-Ground Cast Metal Box:

1. Manufacturers:
   a. Appleton Electric Co.
   b. Thomas & Betts Corp.
   c. Crouse-Hinds/Cooper Industries.
   d. O-Z/Gedney.
   f. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

2. Description: NEMA 250, Type 4 or 6, outside flanged, recessed cover box for flush mounting.

3. Material: Galvanized cast iron or cast aluminum.

4. Cover: Nonskid cover with neoprene gasket and stainless steel cover screws.

5. Cover Legend: “ELECTRIC,” “SIGNAL” or “COMMUNICATIONS,” as indicated on the Drawings.

E. In-Ground Non-Metallic Box:

1. Manufacturers:
   a. Strongwell (Quazite Div., MMFG), Type “PC” or “PG”.
   b. Carlon Electrical Products, Type “E989”.
   c. Cantex, Inc.
   d. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

2. Description: NEMA 250, Type 3R/4, outside flanged, recessed cover box for flush mounting. Provide pre-cut 6 inch x 6 inch cable entrance at center bottom of each side where indicated.

3. Material: Polymer concrete or PVC.

4. Cover: Nonskid cover with neoprene gasket and stainless steel cover screws.

5. Cover Legend: “ELECTRIC,” “SIGNAL” or “COMMUNICATIONS,” as indicated on the Drawings.
PART 3 EXECUTION

3.1 EXAMINATION

A. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 EXISTING WORK

A. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces.

B. Remove concealed abandoned raceway to its source.

C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets when raceway is abandoned and removed. Install blank cover for abandoned outlets not removed.

D. Maintain access to existing boxes and other installations remaining active and requiring access. Modify installation or provide access panel.

E. Extend existing raceway and box installations using materials and methods compatible with existing electrical installations, or as specified.

F. Clean and repair existing raceway and boxes to remain or to be reinstalled.

3.3 INSTALLATION

A. Ground and bond raceway and boxes in accordance with Section 16060.

B. Fasten raceway and box supports to structure and finishes in accordance with Section 16070.

C. Identify raceway and boxes in accordance with Section 16075.

D. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.4 INSTALLATION - RACEWAY

A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.

B. Arrange raceway supports to prevent misalignment during wiring installation.

C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
D. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 16070; provide space on each for 25 percent additional raceways.

E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports.

F. Do not attach raceway to ceiling support wires or other piping systems.

G. Construct wireway supports from steel channel specified in Section 16070.

H. Route exposed raceway parallel and perpendicular to walls.

I. Route raceway installed above accessible ceilings parallel and perpendicular to walls.

J. Route conduit in and under slab from point-to-point. Do not cross conduits in slab.

K. Maintain clearance between raceway and piping for maintenance purposes.

L. Maintain 12 inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.

M. Cut conduit square using saw or pipe cutter; de-burr cut ends.

N. Bring conduit to shoulder of fittings; fasten securely.

O. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.

P. Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

Q. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install factory elbows for bends in metal conduit larger than 2 inch size, or use hydraulic one-shot bender to fabricate.

R. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.

S. Install fittings to accommodate expansion and deflection where raceway crosses seismic, control and expansion joints.

T. Install suitable pull string or cord in each empty raceway except sleeves and nipples.
U. Install suitable caps to protect installed conduit against entrance of dirt and moisture.

V. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.

W. Close ends and unused openings in wireway.

3.5 INSTALLATION - BOXES

A. Install wall mounted boxes at elevations to accommodate mounting heights specified in Section 16140, unless otherwise indicated on Drawings.

B. Orient boxes to accommodate wiring devices as specified in Section 16140. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.

C. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

D. In accessible ceiling areas, install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

E. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

F. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.

G. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

H. Install stamped steel bridges to fasten flush mounting outlet box between studs.

I. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

J. Install adjustable steel channel fasteners for hung ceiling outlet box.

K. Do not fasten boxes to ceiling support wires or other piping systems.

L. Support boxes independently of conduit.

M. Install gang box where more than one device is mounted together. Do not use sectional box.

N. Install gang box with plaster ring for single device outlets.
3.6 INTERFACE WITH OTHER PRODUCTS
A. Install conduits and boxes to preserve fire resistance rating of partitions and other elements.
B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation.
C. Locate outlet boxes to allow luminaires positioned as indicated on reflected ceiling plan.
D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.7 ADJUSTING
A. Adjust flush-mounting outlets to make front flush with finished wall material.
B. Install knockout closures in unused openings in boxes.

3.8 CLEANING
A. Clean interior of boxes to remove dust, debris, and other material.
B. Clean exposed surfaces and restore finish.

PART 4 COMPENSATION
4.1 MEASUREMENT AND PAYMENT
A. Measurement: The work of this section shall not be measured.
B. Payment: The cost of this section shall be included in the lump sum bid item ELECTRICAL.

END OF SECTION
SECTION 16132
BUILDING WIRE AND CABLE

PART 1 GENERAL

1.1 SUMMARY

A. Section includes building wire and cable; metal clad cable; and wiring connectors and connections.

1.2 REFERENCES

A. International Electrical Testing Association:

B. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code.

1.3 SYSTEM DESCRIPTION

A. Product Requirements: Provide products as follows:
   1. Solid conductor for feeders and branch circuits 10 AWG and smaller.
   2. Stranded conductors for control circuits.
   3. Conductors shall not be smaller than 12 AWG for power and lighting circuits.
   4. Conductors shall not be smaller than 16 AWG for control circuits.
   5. 10 AWG conductors for 20 ampere, 120-volt branch circuits longer than 75 feet.
   6. 10 AWG conductors for 20 ampere, 277-volt branch circuits longer than 200 feet.

B. Wiring Methods: Provide the following wiring methods:
   1. Concealed Dry Interior Locations: Use only building wire, Type THHN/THWN-2 insulation, in raceway; or, metal clad cable.
   2. Exposed Dry Interior Locations: Use only building wire, Type THHN/THWN-2 insulation, in raceway.
   3. Above Accessible Ceilings: Use only building wire, Type THHN/THWN-2 insulation, in raceway; or, metal clad cable.
   4. Wet or Damp Interior Locations: Use only building wire, Type XHHW-2 insulation, in raceway.
   5. Exterior Locations: Use only building wire, Type XHHW-2 insulation, in raceway.
   6. Underground Locations: Use only building wire, Type XHHW-2 insulation, in raceway.
   7. Use wiring methods indicated on Contract drawings where different from the above requirements.
1.4 DESIGN REQUIREMENTS

A. Conductor sizes are based on copper. Aluminum conductors shall not be substituted for copper conductors.

B. When using alternate routing of conductors than that shown on Drawings, size conductors to match circuit requirements for voltage drop.

1.5 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Product Data: Submit for building wire and each cable assembly type.

C. Design Data: Indicate voltage drop and ampacity calculations for alternate routing of conductors.

D. Test Reports: Indicate procedures and values obtained.

1.6 CLOSEOUT SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Project Record Documents: Record actual locations of components and circuits.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.8 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on Drawings.

1.9 COORDINATION

A. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

B. Wire and cable routing indicated is approximate unless dimensioned. Include wire and cable lengths within 10 feet of length shown.

PART 2 PRODUCTS

2.1 BUILDING WIRE

A. Manufacturers:
   1. Southwire Co.
3. Essex Electrical Products / Essex Electric, Inc.
4. The Okonite Co.
5. Aetna Insulated Wire Co.
6. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Product Description: Single conductor insulated wire.

C. Conductor: Copper.

D. Insulation: 600 volt rating; Type THHN/THWN-2 thermoplastic or type XHHW-2 thermosetting material, as allowed by requirements for wiring methods above; rated 90 degrees C.

2.2 METAL CLAD CABLE

A. Manufacturers:
   1. Southwire Co.
   2. AFC Cable Systems.
   3. General Cable Co.
   4. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Product Description: Multi-conductor cable assembly with interlocked metal tape sheath and insulated wires.

C. Conductor: Copper.

D. Insulation: 600 volt rating; Type THHN/THWN-2 thermoplastic or type XHHW-2 thermosetting material, as allowed by requirements for wiring methods above; rated 90 degrees C.

E. Armor: Steel or aluminum.

F. Jacket: Where required.

2.3 WIRING CONNECTORS

A. Spring Wire Connectors:
   1. Ideal Industries, Inc., “Wire-Nut” or “Wing-Nut”.
   2. King Innovation, “SafetyGuard” or “EasyGuard”.
   3. 3M Corp., “ScotchLok” or “Highland”.
   4. NSi Industries, LLC, “Easy-Twist”.
   5. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Compression Connectors:
   1. Ideal Industries, Inc.
2. Panduit Corp.
3. ILSCO Corp.
4. NSi Industries, LLC.
5. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

C. Split Bolt Connectors:
1. Ideal Industries, Inc.
2. Panduit Corp.
3. ILSCO Corp.
4. NSi Industries, LLC.
5. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify interior of building has been protected from weather.

B. Verify mechanical work likely to damage wire and cable has been completed.

C. Verify raceway installation is complete and supported.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3 EXISTING WORK

A. Remove exposed abandoned wire and cable, including abandoned wire and cable above accessible ceiling finishes. Patch surfaces where removed cables pass through building finishes.

B. Disconnect abandoned circuits and remove circuit wire and cable. Remove abandoned boxes when wire and cable servicing boxes is abandoned and removed. Install blank cover for abandoned boxes not removed.

C. Provide access to existing wiring connections remaining active and requiring access. Modify installation or install access panel.

D. Extend existing circuits using materials and methods compatible with existing electrical installations, or as specified.

E. Clean and repair existing wire and cable remaining or wire and cable to be reinstalled.
3.4 INSTALLATION

A. Route wire and cable to meet Project conditions.

B. Neatly train and lace wiring inside boxes, equipment, and panelboards.

C. Identify and color code wire and cable under provisions of Section 16075. Identify each conductor with its circuit number or other designation indicated.

D. Building Wire in Raceway:
   1. Pull conductors into raceway at same time.
   2. Install building wire 4 AWG and larger with pulling equipment.

E. Cable:
   1. Protect exposed cable from damage.
   2. Support cables above accessible ceiling, using spring metal clips or cable ties to support cables from structure. Do not rest cable on ceiling panels or support from ceiling suspension system.
   3. Use suitable cable fittings and connectors.

F. Wiring Connections:
   1. Clean conductor surfaces before installing lugs and connectors.
   2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
   3. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
   4. Install split bolt connectors for copper conductor splices and taps, 6 AWG and larger.
   5. Install compression connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
   6. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

G. Install solid conductor for feeders and branch circuits 10 AWG and smaller.

H. Install stranded conductors for control circuits. Install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.

3.5 WIRE COLOR

A. General
   1. For wire sizes 10 AWG and smaller, install wire colors in accordance with the following:
      a. Black, red, and blue for circuits at 120/208 volts single or three phase.
      b. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.
2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:
   a. Black, red, and blue for circuits at 120/208 volts single or three phase.
   b. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.

B. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.

C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color-coded.

D. Feeder Circuit Conductors: Uniquely color code each phase.

E. Ground Conductors:
   1. For 6 AWG and smaller: Green.
   2. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

3.6 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item ELECTRICAL.

END OF SECTION
SECTION 16140
WIRING DEVICES

PART 1 GENERAL

1.1 SUMMARY
A. Section includes wall switches; receptacles; and device plates/box covers.
B. Related Sections:
   1. Section 16130 – Raceway and Boxes: Outlet boxes for wiring devices.
   2. Section 16150 – Wiring Connections.

1.2 REFERENCES
A. National Electrical Manufacturers Association:
   1. NEMA WD 1 – General Requirements for Wiring Devices.
   2. NEMA WD 6 – Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS
A. Submit in accordance with General Provisions for Construction.
B. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.

1.4 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.5 EXTRA MATERIALS
A. Furnish two of each style, size, and finish wall plate.

PART 2 PRODUCTS

2.1 WALL SWITCHES
A. Manufacturers:
   3. Cooper Wiring Devices, Model 2221B.
6. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Product Description: NEMA WD 1, single pole, heavy-duty, AC only general-use snap switch.
   1. Body and Handle: Brown plastic with toggle handle.
   2. Voltage: 120-277 volts, AC.

2.2 RECEPTACLES

A. Single Convenience Receptacle:
   3. Cooper Wiring Devices, Model 5361B.
   4. Pass & Seymour/Legrand, Model PS5361.
   6. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. GFCI Receptacle (single and duplex):
   1. Hubbell, Inc. Model GF5362A.
   3. Cooper Wiring Devices, Model XGF20B.
   4. Pass & Seymour/Legrand, Model 2094.
   5. Bryant Electric, Inc., Model GF53A.
   6. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

C. Product Description: NEMA WD 1, Heavy-duty, general use receptacle.
   1. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

2.3 WALL PLATES

A. Weatherproof Cover Plate: Gasketed cast metal plate with hinged and gasketed device cover at all device locations.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify outlet boxes are installed at proper height.

B. Verify wall openings are neatly cut and completely covered by wall plates.

C. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
3.2 PREPARATION
A. Clean debris from outlet boxes.

3.3 EXISTING WORK
A. Disconnect and remove all existing wiring devices.

3.4 INSTALLATION
A. Install devices plumb and level.
B. Install switches with OFF position down.
C. Install receptacles with grounding pole on bottom, GFI type.
D. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.
E. Install weatherproof plates on switch, receptacle, and blank outlets in finished areas.

3.5 INTERFACE WITH OTHER PRODUCTS
A. Coordinate locations of outlet boxes provided under Section 16130 to obtain mounting heights as specified and/or as indicated on drawings.
B. Install wall switch 46 inches above finished floor.
C. Install convenience GFI receptacle 18 inches above finished floor.

3.6 FIELD QUALITY CONTROL
A. Inspect each wiring device for defects.
B. Operate each wall switch with circuit energized and verify proper operation.
C. Verify each receptacle device is energized.
D. Test each GFCI receptacle device for proper operation and polarity.

3.7 ADJUSTING
A. Adjust devices and wall plates to level.

3.8 CLEANING
A. Clean exposed surfaces to remove splatters and restore finish.
PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item ELECTRICAL.

END OF SECTION

THIS PAGE IS INTENTIONALLY LEFT BLANK
SECTION 16150
WIRING CONNECTIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes electrical connections to equipment.

B. Related Sections:
   1. Section 16123 - Building Wire and Cable.
   2. Section 16130 - Raceway and Boxes.
   3. Section 16140 - Wiring Devices.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA WD 1 - General Requirements for Wiring Devices.
   2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Product Data: Submit wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

C. Manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Project Record Documents: Record actual locations, sizes, and configurations of equipment connections.

1.5 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

2.1 CORD AND PLUGS

A. Manufacturers:
   1. Hubbell, Inc.
   3. Cooper Wiring Devices.
   4. Pass & Seymour/Legrand.
   5. Bryant Electric, Inc.
   6. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Attachment Plug Construction: Conform to NEMA WD 1.

C. Configuration: NEMA WD 6; match receptacle configuration at outlet furnished for equipment.

D. Cord Construction: Type SJO multi-conductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.

E. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify equipment is ready for electrical connection, for wiring, and to be energized.

3.2 EXISTING WORK

A. Remove exposed abandoned equipment wiring connections, including abandoned connections above accessible ceiling finishes.

B. Disconnect abandoned utilization equipment and remove wiring connections. Remove abandoned components when connected raceway is abandoned and removed. Install blank cover for abandoned boxes and enclosures not removed.

C. Extend existing equipment connections using materials and methods compatible with existing electrical installations, or as specified.

3.3 INSTALLATION

A. Make electrical connections.
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. Install GFI receptacle outlet to accommodate connection with attachment plug.

E. Install cord and cap for field-supplied attachment plug.

F. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

G. Install terminal block jumpers to complete equipment wiring requirements.

H. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

3.4 ADJUSTING

A. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item ELECTRICAL.

END OF SECTION
THIS PAGE IS INTENTIONALLY LEFT BLANK
SECTION 26 28 16.17
POWER MODULE SWITCH

PART 1 GENERAL

1.1 DESCRIPTION
A. Work of this section shall conform to the requirements of the Contract Documents.

1.2 SECTION INCLUDES
A. Provide Elevator Power Module Switch(es), fuses and accessories as required and specified on Contract Drawings to distribute electrical power to all Elevators.

1.3 RELATED SYSTEMS
A. (Reference other sections of the specification which cover Elevator installation)

1.4 CODES
A. All work shall be performed in accordance with the latest edition of applicable standards, codes and laws.
1. NEC – 2011 Section 620-51 (a)-(c), 620-62, 620-91 (c)
2. ANSI/ASME A17.3 – 2007 Section 2.1.4 (c)
4. BOCA 3006.2.3
5. NFPA 72 – 2002 Section 6-15.4.4

1.5 STANDARDS
A. Except as modified by governing codes, all equipment shall be manufactured in accordance with the latest applicable standards:
1. Enclosed Switches, U.L. 98 and CSA – C22.2 No.4.

1.6 QUALIFICATIONS
A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.7 SUBMITTALS
A. Submit shop drawings and product data under the provisions of the General Conditions.
B. Product Data: Provide manufacturer’s catalog information showing dimensions, configurations, and methods of mounting and installation.

1.8 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer’s instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

B. Submit listing of all types, sizes and quantity of fuses, which will be installed including the location of each.

C. Spare fuses shall be supplied as required by (reference fuse specification section).

PART 2 PRODUCTS

2.1 MANUFACTURES

A. Cooper Bussmann Power Module™ Switch - PS
B. Eaton
C. Or Approved Equal

2.2 GENERAL CONDITIONS & REQUIREMENTS

A. Provide Elevator Control Switch in a single NEMA enclosure with all necessary relay(s), control transformer and other options (as listed below), and as shown on drawings. The Elevator Control Switch shall be constructed, listed, and certified to the standards as listed in above. The Elevator Control Switch shall have an ampere rating as shown on the Contract Drawings, and shall include a horsepower rated fusible switch with shunt trip capabilities. The ampere rating of the switch shall be based upon elevator manufacturer requirements and utilize Class J Fuses (provided separately). It shall include as an accessory, a 100 VA control power transformer with primary and secondary fuses. The primary voltage rating shall be 480 volts with a 120 volt secondary. It shall also contain an isolation relay (3PDT, 10 amp, and 120V). The coil of the isolation relay shall be 120 Vac. A normally open dry contact shall be provided by the Fire Alarm Safety System to energize the isolation relay and activate the shunt trip solenoid (140 VA inrush at 120V). (Note: If 24 Vdc coil is selected, a separate 24 Vdc source and contact must be provided by the Fire Alarm Safety System.) The switch shall include a 120 volt key to test switch and a 1-NO/1-NC mechanically interlocked auxiliary contact rated 5A, 120 Vac as standard. The switch shall contain the following options:

1. “ON” Pilot Light (Green, Red or White)
2. Isolated Full Capacity Neutral Lug
3. Fire Alarm Voltage Monitoring Relay (Needed to comply with NFPA 72)
4. NEMA Type 1 Enclosure
5. Main Switch Auxiliary Contacts (1 NO/1 NC)

Complete catalog number for the Elevator Control Switch shall be PS2T48R1KGN1BF3 or approved equal. The module shall be successfully tested to a short circuit rating with
Bussmann® Low-Peak® Class J fuses at 200,000 amps RMS Symmetrical. All switches shall have shunt trip capabilities at 120 Vac from remote fire safety signal. Branch feeders shall be selectively coordinated and fed with an upstream supply over-current protective device at a minimum of 2:1 size ratio utilizing LOW-PEAK® (Class J, RK1, or L) fuses.

PART 3  EXECUTION

3.1  INSPECTION

A. All material installation shall be in accordance with manufacturer’s recommendations and the provisions of applicable codes.

B. Fuses shall not be installed until equipment is ready to be energized.

3.2  TESTING

A. All testing on a project shall be done by a State Classified testing agency and all costs are to be paid by Contractor. Electronic copies should be provided.

END OF SECTION
SECTION 16412
ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SUMMARY
A. Section includes fusible and nonfusible switches.
B. Related Sections:
   1. Section 16491 - Fuses.

1.2 REFERENCES
A. National Electrical Manufacturers Association:
   1. NEMA FU 1 - Low Voltage Cartridge Fuses.
   2. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
B. International Electrical Testing Association:

1.3 SUBMITTALS
A. Submit in accordance with General Provisions for Construction.
B. Product Data: Submit switch ratings and enclosure dimensions.

1.4 CLOSEOUT SUBMITTALS
A. Submit in accordance with General Provisions for Construction.
B. Project Record Documents: Record actual locations of enclosed switches and ratings of installed fuses.

1.5 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 FUSIBLE SWITCH ASSEMBLIES
A. Manufacturers:
1. General Electric Co.
2. Siemens Energy and Automation, Inc.
3. Square D Div., Schneider Electric SA.
5. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Product Description: NEMA KS 1, Type HD, with externally operable handle interlocked to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Handle lockable in OFF position.

C. Fuse clips: Designed to accommodate NEMA FU 1, Class R, J or L fuses (as applicable).

D. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer’s standard gray enamel.
   1. Dry, Interior, Finished Locations: NEMA Type 1.
   2. Dry, Interior, Unfinished Locations: NEMA Type 12.
   3. Damp, Interior Locations: NEMA Type 3R or 4.
   5. Exterior Locations: NEMA Type 3R or 4.
   6. Corrosive Locations: NEMA Type 4X.
   7. Hazardous (Classified) Locations: NEMA Type 7 (Class I) or 9 (Class II).

E. Furnish switches with entirely copper current carrying parts.

2.2 NONFUSIBLE SWITCH ASSEMBLIES

A. Manufacturers:
   1. General Electric Co.
   2. Siemens Energy and Automation, Inc.
   3. Square D Div., Schneider Electric SA.
   5. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Product Description: NEMA KS 1, Type HD with externally operable handle interlocked to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Handle lockable in OFF position.

C. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer’s standard gray enamel.
   1. Dry, Interior, Finished Locations: NEMA Type 1.
   2. Dry, Interior, Unfinished Locations: NEMA Type 12.
   3. Damp, Interior Locations: NEMA Type 3R or 4.
   5. Exterior Locations: NEMA Type 3R or 4.
   6. Corrosive Locations: NEMA Type 4X.
   7. Hazardous (Classified) Locations: NEMA Type 7 (Class I) or 9 (Class II).
2.3 SWITCH RATINGS

A. Switch Rating: Horsepower rated for AC or DC as indicated on Drawings.

B. Short Circuit Current Rating: UL listed 200,000 rms symmetrical amperes when used with or protected by Class R or Class J fuses (30-600 ampere switches employing appropriate fuse rejection schemes); and 200,000 rms symmetrical amperes when used with or protected by Class L fuses (800-1200 ampere).

PART 3 EXECUTION

3.1 EXISTING WORK

A. Disconnect and remove abandoned enclosed switches.

B. Maintain access to existing enclosed switches and other installations remaining active and requiring access. Modify installation or provide access panel.

C. Clean and repair existing enclosed switches to remain or to be reinstalled.

3.2 INSTALLATION

A. Install enclosed switches plumb. Provide supports in accordance with Section 16070.

B. Height: 5 feet to operating handle.

C. Install fuses for fusible disconnect switches. Refer to Section 16491 for product requirements.

D. Install engraved plastic nameplates in accordance with Section 16075.

E. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.5.

PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.
B. Payment: The cost of this section shall be included in the lump sum bid item ELECTRICAL.

END OF SECTION
SECTION 16442
PANELBOARDS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes distribution and branch circuit panelboards.

B. Related Sections:
   1. Section 16060 - Grounding and Bonding.
   2. Section 16075 - Electrical Identification

1.2 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
   2. NEMA FU 1 - Low Voltage Cartridge Fuses.
   3. NEMA PB 1 - Panelboards.
   4. NEMA PB 1.1 - General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

B. International Electrical Testing Association:

C. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

C. Product Data: Submit catalog data showing specified features of standard products.

1.4 CLOSEOUT SUBMITTALS

A. Submit in accordance with General Provisions for Construction.

B. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.
C. Operation and Maintenance Data: Submit spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under requirements of General Provisions for Construction.

B. Accept panelboards on site. Inspect for damage.

C. Protect panelboards from dust and debris by wrapping unit in dust tight cover and storing away from construction activity.

1.7 MAINTENANCE MATERIALS

A. Furnish in accordance with General Provisions for Construction.

B. Furnish two of each panelboard key. Panelboards keyed alike.

PART 2 PRODUCTS

2.1 DISTRIBUTION PANELBOARDS

A. Manufacturers:
   1. Square D Div., Schneider Electric SA.
   2. General Electric Co.
   5. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Product Description: NEMA PB 1, circuit breaker type panelboard.

C. Panelboard Bus: Copper current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.

D. Minimum integrated short circuit rating: 22,000 amperes rms symmetrical for 120/208-230 volt panelboards; 65,000 amperes rms symmetrical for 277/480 volt panelboards, or as otherwise indicated on Drawings.
E. Molded Case Circuit Breakers: NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Furnish circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

F. Molded Case Circuit Breakers with Current Limiters: NEMA AB 1, circuit breakers with replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole.

G. Current Limiting Molded Case Circuit Breakers: NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size NEMA FU 1, Class RK-5 fuse.

H. Circuit Breaker Accessories: Trip units and auxiliary switches as indicated on Drawings.

I. Enclosure: NEMA PB 1, cabinet box.
   1. Dry, Interior, Finished Locations: NEMA Type 1.
   2. Dry, Interior, Unfinished Locations: NEMA Type 12.
   3. Damp, Interior Locations: NEMA Type 3R or 4.
   5. Exterior Locations: NEMA Type 3R or 4.
   6. Corrosive Locations: NEMA Type 4X.
   7. Hazardous (Classified) Locations: NEMA Type 7 (Class I) or 9 (Class II).

J. Cabinet Front: Surface mounted, fastened with screws, with hinged door, flush lock, and directory frame; finished in manufacturer's standard gray enamel.

K. Lockouts- Where panel schedules indicate that a lock-out device is required, the circuit breaker shall be provided with a permanently install means to add a padlock in the open position. The provision for locking or adding a lock shall remain in place with or without the lock installed.

2.2 BRANCH CIRCUIT PANELBOARDS

A. Manufacturers:
   1. General Electric Co.
   2. Siemens Energy and Automation, Inc.
   3. Square D Div., Schneider Electric SA.
   5. Substitutions: Submit requests for substitution in accordance with the General Provisions for Construction.

B. Product Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.
C. Panelboard Bus: Copper current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard; furnish insulated ground bus as indicated on Drawings.

D. For non-linear load applications subject to harmonics furnish 200 percent rated, plated copper, solid neutral.

E. Minimum Integrated Short Circuit Rating: 22,000 amperes rms symmetrical for 120/208-230 volt panelboards; 65,000 amperes rms symmetrical for 277/480 volt panelboards, or as otherwise indicated on Drawings.

F. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers as indicated on Drawings. Do not use tandem circuit breakers.

G. Current Limiting Molded Case Circuit Breakers: NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size NEMA FU 1, Class RK-5 fuse.

H. Enclosure: NEMA PB 1, cabinet box.
   1. Dry, Interior, Finished Locations: NEMA Type 1.
   2. Dry, Interior, Unfinished Locations: NEMA Type 12.
   5. Exterior Locations: NEMA Type 3R or 4.
   6. Corrosive Locations: NEMA Type 4X.
   7. Hazardous (Classified) Locations: NEMA Type 7 (Class I) or 9 (Class II).

I. Cabinet Front: Flush or surface mount, as indicated on Drawings, with metal directory frame, and flush lock keyed alike; finished in manufacturer's standard gray enamel.
   1. Flush Mount: Concealed trim clamps, concealed hinge.
   2. Surface Mount: Fastened with screws, hinged door.

J. Lockouts- Where panel schedules indicate that a lock-out device is required, the circuit breaker shall be provided with a permanently install means to add a padlock in the open position. The provision for locking or adding a lock shall remain in place with or without the lock installed.
PART 3 EXECUTION

3.1 EXISTING WORK

A. Disconnect and remove abandoned panelboards as indicated on Drawings.
B. Maintain access to existing panelboard remaining active and requiring access. Modify installation or provide access panel.
C. Clean and repair existing panelboards to remain or to be reinstalled.

3.2 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1.
B. Install panelboards plumb.
C. Install recessed panelboards flush with wall finishes.
D. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.
E. Install filler plates for unused spaces in panelboards.
F. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes to balance phase loads.
G. Install engraved plastic nameplates in accordance with Section 16075.
H. Install spare conduits out of each recessed panelboard to accessible location above ceiling. Minimum spare conduits: 5 empty, 3/4-inch size. Identify each as “SPARE”.
I. Ground and bond panelboard enclosure according to Section 16060. Connect equipment ground bars of panels in accordance with NFPA 70.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.
B. Perform circuit breaker inspections and tests listed in NETA ATS, Section 7.6.

3.4 ADJUSTING

A. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20-percent of each other. Maintain proper phasing for multi-wire branch circuits.
PART 4 COMPENSATION

4.1 MEASUREMENT AND PAYMENT

A. Measurement: The work of this section shall not be measured.

B. Payment: The cost of this section shall be included in the lump sum bid item ELECTRICAL.

END OF SECTION
PART 1  GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for general and emergency egress lighting equipment, components, and related installation.

B. Related Sections:
   1. Section 16060 - Grounding and Bonding.
   2. Section 16070 - Hangers and Supports.
   4. Section 16132 – Surface Raceway (Building Wire and Cable).
   5. Section 16130 – Raceway and Boxes.

1.2 REFERENCES

A. The Aluminum Association, Inc. (AA):
   1. DAF-45, Designation System for Aluminum Finishes.

B. American National Standards Institute (ANSI).
   1. ANSI C81.64, Guidelines and General Information for Electrical Lamp Bases, Lampholders and Gauges.
   2. ANSI C81.64a, Electric Lamp Bases and Holders - Guidelines and General Information for Electrical Lamp Bases, Lampholders and Gauges.
   3. ANSI C82.77, Lamp Ballasts - Harmonic Emission Limits - Related Power Quality Requirements for Lighting Equipment.

C. Federal Communications Commission (FCC)

D. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   1. IEEE C62.41; Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits.

E. Illuminating Society of North America (IESNA)
   1. IESNA LM-79, Electrical and Photometric Measurements of Solid-State Lighting Products
   2. IESNA LM-80, Approved Method for Measuring Lumen Maintenance of LED Lighting Sources
   3. IESNA TM-15, Luminaire Classification System for Outdoor Luminaires.

F. National Electrical Manufacturers Association (NEMA):
   1. NEMA 250, Enclosures for Electrical Equipment.
   2. NEMA SSL 3, High Power White LED Binning for General Illumination
G. National Fire Protection Association (NFPA):
   1. NFPA 70, National Electrical Code (NEC).

H. Underwriter's Laboratories, Inc. (UL):
   2. UL 1574, Standard for Safety of Track Lighting Systems.
   3. UL 1598, Standard for Safety of Luminaires.
   5. UL 2108, Standard of Safety of Low Voltage Lighting Systems.

I. U. S. Government:
   1. Occupational Safety and Health Administration (OSHA):
      b. 29 CFR 1926 Safety and Health Regulations for Construction.
   2. Federal Communications Commission (FCC):
      a. 47 CFR 18 Industrial, Scientific, and Medical Equipment.
   3. Department of Energy (DOE):

1.3 DEFINITIONS

A. LED – An acronym for “Light-Emitting Diode” used to indicate a semiconductor light source.

1.4 DESIGN REQUIREMENTS

A. Design Criteria:
   1. The Lighting Fixture Schedule on the Contract Drawings constitutes the basis of the lighting design for this Contract, but may not indicate the special design details required.
      a. The Lighting Fixture Schedule includes the lighting fixture descriptions, fixture manufacturers, and corresponding model numbers.
      b. The lighting fixtures as scheduled meet the requirements of the lighting design for this Contract with respect to the visible style, and lenses desired.
   2. Provide lighting fixtures meeting the requirements of the basis of the lighting design for this Contract, and which have the special details specified in this Section.
      a. Submit Shop Drawings and manufacturer’s installation instructions to show details of assemblies and sub-assemblies, and specially-fabricated supporting and fastening devices.
      b. Submit bills of material for the fixtures and their appurtenances.
         1) Reference the bills of material to the Shop Drawings.
         2) Identify each part with a part number and/or manufacturer number.
      c. Provide fixtures for exterior installation that are designed to be completely waterproof.
      d. Provide luminaire brackets designed to be compatible with configuration of the luminaire.
B. Prior to providing light fixtures substituted for the fixtures identified in the Lighting Fixture Schedule on the Contract Drawings, submit the following information to obtain the Engineer’s approval to substitute the fixtures:

1. The manufacturer’s catalog cuts indicating the type, design, dimensions, mounting arrangement, and other industry standard lighting fixture information.
   a. Describe the lighting fixtures, exit signs, emergency battery units, and appurtenances.

2. Manufacturer’s photometric data, distribution curves, isolux charts, glare factor data, and coefficient of utilization.

3. Complete photometric data for the fixture, including optical performance, completed by an independent testing laboratory developed according to the standards of the Illuminating Engineering Society of North America as follows:
   a. For direct, direct/indirect and indirect lights used for general illumination:
      1) Coefficients of utilization.
      2) Candlepower data, presented graphically and numerically, in 5 degree increments (5 degree, 10 degree, 15 degree, etc.). Data developed for up and down quadrants of normal, parallel, and at 22-1/2 degree, 45 degree, 67-1/2 degree planes to lamp(s). If light output is asymmetric, provide additional planes as required to complete report.
      3) Zonal lumens stated numerically in 10 degree increments (5 degree, 15 degree, etc.) as above.
      4) Average luminaire luminance calculated in the lengthwise, crosswise, and 45 degree vertical planes.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. The execution of work of this Section must satisfy the applicable requirements of the latest edition of NFPA 70 (NEC), the National Occupational Safety and Health Act as embodied in 29 CFR 1910 and 29 CFR 1926, and regulations of local jurisdictional authorities.


B. Certifications:

1. All products must be Underwriters’ Laboratories (UL) listed; and each fixture, Emergency Battery Unit, and exit sign must bear the UL label.
   a. The UL standards appropriate for the products specified are listed in Paragraph 1.02.E.
   b. Alternatively, Listing by an OSHA Nationally Recognized Testing Laboratory (NRTL) to the relevant UL standards is permitted.

2. Fixtures that are to be installed in areas subject to the weather must be UL listed as "Enclosed and gasketed suitable for wet locations".

1.6 SUBMITTALS

A. Submit the following information for approval in accordance with the requirements of Submittal Procedures:

1. Product Data:
   a. Manufacturer’s catalog cuts.
1) Lighting fixtures catalog cuts
   b. Manufacturer's photometric data, distribution curves, isolux charts, glare factor data, and coefficients of utilization for each lighting fixture type.

2. Shop Drawings:
   a. Shop Drawings.
   b. Bills of material.

3. Quality Assurance/Quality Control Submittals:
   a. Design Data:
      1) Calculations demonstrating that substituted fixtures are equivalent to the named fixtures.
   b. Certificates:
      1) Proof that equipment furnished has the required Underwriters’ Laboratories (UL) listing.
   c. Manufacturer's Instructions:
      1) Manufacturer's installation instructions.

1.7 EXTRA MATERIALS

A. Maintenance Tools:
   1. Provide two each of the special maintenance tools as may be necessary for re-lamping fixtures and for fixture maintenance.

B. As the equipment for which the extra materials can be used is substantially completed, turn the extra materials for that equipment over to the Owner.

PART 2 PRODUCTS

2.1 MATERIALS

A. Conduit and Raceway:
   1. Provide electrical conduit and raceway in accordance with the requirements of Section 16130 and Section 16132 as indicated and as appropriate for the application per NFPA 70.

B. Control Devices:
   1. Provide electrical lighting control devices in accordance with the requirements of Section 16140.

C. Fixture Support Devices and Fasteners:
   1. In addition to the supporting devices and fasteners specified in Section 16070, provide suspension accessories, canopies, casing, sockets, holders, reflectors, plaster frames, recessing boxes, and similar items required to support the lighting equipment and luminaries as specified or indicated.

D. Wire and Cable:
   1. Provide electrical wire and cable in accordance with the requirements of Section 16132.

2.2 MANUFACTURED UNITS

A. Light Fixtures:
1. Provide those fixtures indicated on the Lighting Fixture Schedule on the Contract Drawings or approved substitutions.
   a. The manufacturers’ fixture descriptions and corresponding fixture model numbers are also listed in the Lighting Fixture Schedule.
   b. Additional manufacturers who can provide products comparable to those provided by the manufacturers listed and whose products the Contractor proposes to use for this Contract must first be submitted to and receive the approval of the Engineer prior to being substituted for the listed manufacturers.

2. Fixture Grounding Device and Conductor:
   a. Provide the housing of each fixture with a separate, factory-installed grounding device and ground conductor.

3. Exterior Fixtures:
      1) Provide outlet boxes, neoprene gaskets, and stainless steel hardware to render the exterior fixture installation waterproof.
   b. Finish:
      1) Provide fixtures for exterior installation with a finish free of scratches and other surface blemishes.
   c. Brackets:
      1) Provide brackets of the type and style indicated or scheduled on the Contract Drawings and color matched to the light fixture.

4. Elevator Pit Fixtures:
      1) Provide outlet boxes, neoprene gaskets, and stainless steel hardware to render the exterior fixture installation waterproof.
   b. Finish:
      1) Provide fixtures for exterior installation with a finish free of scratches and other surface blemishes.
   c. Brackets:
      1) Provide brackets of the type and style indicated or scheduled on the Contract Drawings and color matched to the light fixture.

B. LED Lighting Fixtures (excluding LED exit signs)
   1. Color temperature of any substituted fixture shall be within 10% of the specified value shown on the drawings.
   2. Power consumption of any substituted fixture shall not exceed the specified value shown on the drawings by more than 10%. If a substituted fixture is submitted and approved at an increased wattage within 10% of the specified wattage, any power system modifications necessary to accommodate the fixtures will be the responsibility of the contractor (i.e. increased wire sizes, increased circuit breaker size, additional circuits/breakers, etc.)
   3. LED Lumen Efficacy (Lumens/Watt) of a substituted fixture shall not be less than the specified fixture by more than 10%.
   4. Characteristics of substituted fixtures shall have the same features as the specified LED fixtures (i.e. redundant drivers, driver protection, etc.) whether specifically noted on the lighting fixture schedule or not.
5. Drivers shall not exceed 350mA unless specifically noted otherwise on the lighting fixture schedule. Drivers shall have a Class A sound rating.

6. LED Light fixtures shall have a minimum expected life of 50,000 hours. The aforementioned life rating must be conducted with a 40 degrees calcium ambient temperature.

7. Power Factor: The LED fixture shall have a power factor of 0.90 or greater.

8. Total Harmonic Distortion induced into the AC power line by the luminaire shall not exceed 20 percent.

9. Surge Suppression: The LED fixture on-board circuitry shall include surge protective devices to withstand high repetition noise transients as a result of utility line switching, nearby lightning strikes, and other interference. The SPD shall protect the luminaire from damage and failure for common mode transient peak voltages up to 10 kV (minimum) and transient peak currents up to 5 kA (minimum). SPD shall conform to UL 1449 depending on the components used in the design. SPD performance shall be tested per the procedures in ANSI/IEEE C62.41-1992 (or current edition) for category A (standard). The SPD shall fail in such a way as the Luminaire will no longer operate. The SPD shall be field replaceable.

10. Operational Performance: the LED circuitry shall prevent visible flicker.

11. Thermal Management: The thermal management (of the heat generated by the LED’s) shall be of sufficient capacity to assure the proper operation of the luminaire over the expected useful life. Thermal management shall be by passive design – the use of fans or other mechanical devised is not allowed.
   a. Or Approved equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Prior to ordering flush mounted or lay-in type lighting fixtures, verify their locations and clearances, and coordinate with other construction work to verify that the fixtures will fit without interferences.
   1. The Engineer assumes no responsibility for clearance, dimensions, tolerances, or exact hanging frame dimensions.

B. Prior to beginning installation of the lighting fixtures and accessories, verify that all other work affecting the installation of the lighting fixtures and accessories is complete to the extent that the light fixtures may be installed over substrates or incorporated into integrated systems without adversely affecting the lighting or other construction.

3.2 INSTALLATION

A. Assemble lighting fixtures if required; and install and wire the lighting fixtures, supports, brackets, and accessories at the locations and mounting heights indicated on the Contract Drawings.
   1. Wire the lighting fixtures and accessories as specified in Section 16132.
   2. Ground the lighting fixtures in accordance with the requirements of Article 410 of NFPA 70 (NEC) and Section 16060.
      a. Use the fixture grounding device to connect a separate grounding conductor in compliance with requirements specified in Section 16060.
   3. Install all photoelectric controls facing north for proper operation.
B. Exposed Fixture Installation:
1. Install surface mounted and exposed fixtures as indicated on the Contract Drawings.
   a. Hang suspended fixtures plumb, with continuous rows of fixtures in alignment.
   b. Mount suspended fixtures in each room or area at the same height regardless of varying clear height conditions unless otherwise indicated on the Contract Drawings.
   c. Install surface mounted fixtures tight up against the substrate to eliminate gaps except where NFPA 70 (NEC) or local code restrictions require a separation between the fixtures and substrate.
2. Exit Fixture Installation:
   a. Install exit fixtures for doors directly over the doorways as indicated on the Contract Drawings
   b. Center the fixtures over the doorways, and install the fixtures to clear the door and associated hardware.

3.3 INTERFACE WITH OTHER WORK
A. Verify the locations and clearances of other installed or proposed work, and coordinate lighting fixture installations accordingly.
B. Coordinate the installation of lighting fixtures with all building systems and components to avoid any installation conflicts.

3.4 FIELD QUALITY CONTROL
A. Inspect, test, and certify lighting and the associated electrical distribution system and equipment in accordance with the requirements of Section 16080.

3.5 CLEANING
A. Clean new lighting fixtures by following the cleaning procedures as recommended by the fixture manufacturer:
   1. Use only those products for cleaning as recommended in the fixture manufacturer's literature.

3.6 AIMING AND FOCUSING
A. Contractor shall notify the owner one week in advance and establish schedule for a night when final aiming will be done.
B. Lock the aiming adjustments, set during final aiming, in position. Position must hold during relamping and normal maintenance.

END OF SECTION