

SECTION 02300

EARTHWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

- A. Extent of earthwork is indicated on drawings.
 - 1. Embankment construction.
 - 2. Geotextile installation.

1.03 DEFINITIONS

- A. Excavation consists of removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.
- B. Non-Frost Susceptible (NFS) soils are inorganic soils containing five percent or less by weight grains finer than Sieve No 200. Test method: ASTM C117, C136, D75, and D422.
- C. Fill is material placed above the ground line.
- D. Backfill is material placed in an excavation.
- E. Bedding is material in which buried pipes, cables, and utility appurtenances are set.
- F. Unsuitable Material is material which is inadequate for use in the proposed project.
- G. Compaction is by tamping soils with a hand tool or machine to achieve a specific in-place density.
- H. Classified soils are GW, GP, SW, and SP gradations as defined by the Unified Classification System (UCS).

- I. Unclassified soils consist of sand, gravel, silt, and are free of organic materials, snow, frozen lumps, trash, lumber, or other debris. This material may be frost susceptible. Acceptable materials as classified under the USC are GW, GP, SW, GM, SM, SP, SC, and ML.
- J. Unstable subgrade includes pockets of soft, yielding soil identified during subgrade compaction and soil identified by subgrade inspection.

1.04 QUALITY ASSURANCE

- A. Testing and Inspection Service.
 - 1. Contractor shall engage soil testing and inspection service for quality control testing during earthwork operations. Test results shall be submitted to the Department.
- B. Codes and Standards
 - 1. Perform excavation in compliance with applicable requirements of governing authorities having jurisdiction.

1.05 SUBMITTALS

- A. Test Reports: Submit following reports directly to the Department from the Testing Service, with copy to the Contractor.
 - 1. Test reports for gradation on all Part 2 Soil Materials.
 - 2. Field density test reports.
 - 3. One optimum moisture-maximum density curve for each type of fill/backfill material used.
- B. Submit the following Product Data:
 - 1. Separation Geotextile

1.06 JOB CONDITIONS

- A. Utilities: Coordinate earthwork with utility installations.
- B. Use of Explosives: The use of explosives is not permitted.
- C. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

1. Operate warning lights as required, and/or recommended by authorities having jurisdiction.
2. Protect structures, utilities, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

1.07 SURFACE AND SUBGRADE CONDITIONS FOR EARTHWORK

A. Earthwork Fill and Backfill

1. Fill and backfill shall not be placed over snow accumulation. Subgrade active layer shall have thawed at least 12 inches below the existing surface before placing parking area and driveway embankment.
2. Fill and backfill for all earthwork shall contain absolutely no snow or ice.
3. At time of installation, temperature of soil for all earthwork fill and backfill shall be above freezing.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

- A. Subbase – containing no muck, frozen materials, roots, sod, construction debris, garbage or other deleterious matter and with the following gradation.

<u>U.S. Std. Sieve</u>	<u>Cumulative % Passing by Weight</u>
5 inch	100
3 inch	70 - 100
No. 4	20 - 55
No. 200	0-10 determined on the portion passing the 3" sieve.

- B. Surface Course - containing no muck, frozen materials, roots, sod, construction debris, garbage or other deleterious matter and with the following gradation.

<u>U.S. Std. Sieve</u>	<u>Cumulative % Passing by Weight</u>
3 inch	100
No. 4	20 - 55
No. 200	0-10 determined on the portion passing the 3" sieve.

2.02 SEPARATION GEOTEXTILE

- A. Separation geotextile shall be a non-woven polypropylene fiber geotextile with the following minimum properties.
1. Grab Tensile 235 lb (ASTM D4632)
 2. Mullen Burst 550 psi (ASTM D3786)
 3. Puncture 165 lb (ASTM D4833)
 4. Permittivity 1.1 sec^{-1} (ASTM D4491)

PART 3 - EXECUTION

3.01 EMBANKMENT AND FILL

- A. Construct embankment subbase directly over existing site vegetation mat. Prior to subbase construction, the existing vegetation mat underlying embankments must be kept intact to the greatest extent possible. The following locations are exceptions and will require excavation to prepare the subgrade:
1. Building Piles
- B. See the civil drawings for location of separation geotextile, and depths of fill materials.
- C. General: Place specified soil material in layers to achieve required depths, as shown on the drawings.
- D. Ground Surface Preparation: Remove debris and deleterious materials from the ground surface prior to placement of embankment subbase and geotextile. To the greatest extent possible keep the vegetation mat in place and undisturbed.
- E. Placement and Compaction: Place backfill and fill materials in layers not more than 8 inches in loose depth, for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth, for material compacted by hand-operated tampers.

1. The first subbase lift shall be not more than 14 inches in loose depth. Construct directly over existing surface after separation geotextile placement.
2. Compact each layer to required percentage of maximum dry density or relatively dry density for each area classification.
3. Place backfill and fill materials evenly to required depths.
4. Contractor may increase lift loose thickness from 8 inches to 12 inches, but only upon satisfactory demonstration and acceptance by Testing Agency that his methods and equipment will provide the required compaction.

3.02 EXCAVATION

- A. All excavation is unclassified, and includes excavation to subgrade elevations indicated on the drawings, regardless of character of materials, obstructions encountered, and whether the material is frozen or wet.
- B. To the extent practical, during excavation, segregate existing gravel from unclassified soil for project use. Before reuse soil gradation tests shall be provided to determine soil use.
- C. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations, or dimensions without specific direction by the Department. Unauthorized excavation, as well as remedial work directed, shall be at Contractor's expense.
- D. Stability of Excavation: Slope sides of excavations to comply with local and applicable codes and ordinances having jurisdiction. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
- E. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross-braces, in good serviceable condition.
 1. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.
 2. Maintain shoring and bracing in excavations regardless of the time period excavations will remain open. Construct shoring and bracing as the excavation progresses.
- F. Dewatering: Prevent surface water from flowing into excavations and from flooding project site and surrounding area.
 1. Do not allow water to accumulate in excavations. Provide and maintain pumps, sumps, suction, and discharge lines, and other dewatering system components necessary to convey water away from excavations.

2. Establish and maintain temporary drainage ditches, and other diversions outside excavation limits, to convey rainwater, and water removed from excavations, to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.
- G. Material Storage: Stockpile excavated materials where directed, until required for use. Place, grade, and shape stockpiles for proper drainage.
1. Locate and retain soil materials away from edge of excavations.
 2. Remove excess excavated materials from the site.

3.03 COMPACTION

- A. General: Control soil compaction during construction providing minimum percentage of density specified for each area classification indicated below.
1. Maximum Density: The maximum material density shall be determined by its Modified Proctor maximum dry density, as determined by the procedures described in ASTM D-1557, Test Method for Laboratory Compaction Characteristics Using Modified Effort and, Western Alliance for Quality Transportation Construction (WAQTC) TM 7, In-Place Density of Embankments & Bases Using The Nuclear Moisture-Density Gage. Percentage of maximum dry density for different materials, as shown below:
 - a. Subbase: Compact subbase to a uniform density using a self propelled vibratory roller compactor.
 - b. Surface Course: Compact to at least 95% of maximum density unless otherwise noted on the plans.
 2. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, until optimum moisture content is reached. Apply water in manner to prevent free water appearing on surface during, or subsequent to, compaction operations.
 - a. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

3.04 GRADING

- A. General: Uniformly grade areas, within limits of grading under this section, including adjacent transition areas. Smooth finished surface, within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades. Finish surfaces free from irregular surface changes.

1. Top of soil layers shall be within 0.04 feet (1/2 inch) of required soil layer elevation.
2. After grading to required tolerances, compact soil layer surfaces to required depth and compaction.

3.05 FIELD QUALITY CONTROL

- A. Quality Control Testing During Construction: Allow Testing Service to inspect and approve subgrades and fill layers before further construction work is performed.
- B. Number of tests required:
 1. Embankments and Fill: Minimum of one test per layer for each 75 lineal feet of spacing, or each 1,500 sq. ft. of area, whichever will provide the greater number of tests.
- C. Gradation tests will be taken for each material source and one test thereafter for every 900 cubic yards of material produced, unless modified by the Department during construction, as a result of Contractor's operations.
- D. Each lift of compacted material constructed shall be subject to testing requirement and approval, prior to beginning placement of next lift, and approval of areas of lifts based on visual comparison shall be the responsibility of the Engineer.

3.06 MAINTENANCE

- A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
 1. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
- B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density, prior to further construction.

3.07 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. Removal from Project Site: Remove waste materials, including excess excavated or excess soil, trash, and debris and dispose of it at a Contractor provided site in accordance with all federal, state, and local waste disposal ordinances.

3.08 GEOTEXTILE INSTALLATION

- A. Lay geotextile perpendicular or parallel to direction of driveway traffic. Install geotextile in continuous lengths as much as possible. Overlap adjacent geotextile

sections a minimum of 3 feet. Spread backfill in direction of overlap. Maintain a minimum depth of 12 inches of cover material at all times between fabric and the wheels or tracks of construction equipment. Do not turn construction equipment over the geotextile until at least 12 inches of soil has been installed and compacted above the geotextile.

END OF SECTION

SECTION 02458

H-PILES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes steel H piles.

1.03 ACTION SUBMITTALS

- A. Shop Drawings: For steel piles. Show fabrication and installation details for piles, including details of driving points, splices, and pile caps.
 - 1. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
 - 2. Submit structural analysis data signed and sealed by the qualified professional engineer responsible for preparation of testing equipment and procedures.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer, professional engineer, and testing agency.
- B. Welding certificates.
- C. Pile-Driving Plan: Include a detailed list of the driving equipment, the driving criteria, and contingency procedures to assure piles are installed per the construction documents. The pile driving plan shall be submitted to and approved by the department prior to mobilization of any equipment or supplies relating to pile installation to Mertarvik.
- D. Dynamic Load Test: The Department shall perform a high-strain dynamic load test (ASTM D 4945), with signal matching (CAPWAP analysis) on at least one of the initial structural foundation piles, at the end of driving. The result of this load test shall be evaluated and interpreted by the the Department to: calibrate the W-E analysis, verify the integrity of the pile, and determine the actual hammer efficiency.
- E. Pile-Driving Records: Submit within three days of driving each pile.
- F. Field quality-control reports.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Preinstallation Conference: Conduct conference at a department determined location, date, and time.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver piles to Project site in such quantities and at such times to ensure continuity of installation. Handle and store piles at Project site to prevent buckling or physical damage.
 - 1. Painted Piles: Protect finish and touch up paint damage before driving piles.

1.07 PROJECT CONDITIONS

- A. Protect structures, underground utilities, and other construction from damage caused by pile driving.
- B. Site Information: This specification is in accordance with the foundation recommendations of the geotechnical report. The geotechnical report has been prepared for this Project and is included elsewhere in the Project Manual.

PART 2 PRODUCTS

2.01 STEEL H PILES

- A. High-Strength, Low-Alloy, Structural Steel: ASTM A572 Grade 50.

2.02 PILE ACCESSORIES

- A. Driving Points: A special cutting shoe for penetrating strong/hard rock shall be provided of a material required by the manufacturer.
- B. Splice Unit: Manufacturer's standard splice unit, fabricated from two connected steel plates, of same material as H pile or material of equal strength, shaped to encase web and part of each flange.

2.03 PAINT

- A. Paint: SSPC-Paint 16; self-priming, two-component, coal-tar epoxy polyamide, black.

2.04 FABRICATION

- A. Fabricate and assemble piles in shop to greatest extent possible.
- B. Pile-Length Markings: Mark each pile with horizontal lines at 12-inch (305-mm) intervals; label the distance from pile tip at 60-inch (1.52-m) intervals. Maintain markings on piles until driven.
- C. Fabricate full-length piles by splicing lengths of H pile together. Accurately mill meeting ends of piles and bevel for welding. Maintain axial alignment of pile lengths. Maintain structural properties of pile across splice.
 - 1. Splice Units: Notch web of pile, fit splice unit into position, and weld according to manufacturer's written instructions and AWS D1.1/D1.1M for procedures, appearance and quality of welds, and methods used in correcting welding work.
 - 2. Continuously Welded Splices: Splice piles by continuously welding according to AWS D1.1/D1.1M for procedures, appearance and quality of welds, and methods used in correcting welding work.
 - 3. Splice piles during field installation or during installation if site equipment permits.
 - 4. Alternative pile splices are acceptable with the approval of the department's engineer.
- D. Fit and weld driving points to tip of pile according to manufacturer's written instructions and AWS D1.1/D1.1M for procedures, appearance and quality of welds, and methods used in correcting welding work. Each pile shall be equipped with a special cutting shoe for penetrating strong/hard rock.

2.05 PILE INSTALLATION

- A. A qualified inspector, hired by the department, shall inspect and witness the installation of all structural foundation piles. This inspector shall maintain a log of each pile that verifies the pile section, size, driving shoe, and driving equipment. They shall document the actual hammer performance and pile resistance (hammer blows) per unit length of penetration. They shall list the apparent ultimate capacity at the final set.
- B. Vibratory hammers may be used to initially seat the pile, but an impact hammer shall be used to advance no less than the final 10 feet of pile penetration. Leads shall be used that allow the hammer to move freely along the projected axis of the pile. Followers should not be used to drive piles.

- C. All structural piles shall be installed based on driving criteria determined from a wave equation (W-E) analysis for the actual hammer system. The hammer system and limiting driving criteria shall be determined so that the compressive stresses do not exceed 90% of the specified pile yield stress. Pile refusal can be considered when the pile advances one inch or less after fifteen or more hammer blows, or when the hammer is operating near the maximum allowable driving stress.

2.06 SHOP PAINTING

- A. General: Shop paint steel pile surfaces, except for surfaces to be encased in concrete, as follows:
 - 1. Extend painting to a depth of 60 inches (1.52 m) below finished grade to top of exposed pile.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and loose mill scale, spatter, slag, and flux deposits. Prepare surfaces according to SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning."
- C. Painting: Immediately after surface preparation, apply coat of paint according to manufacturer's written instructions to provide a dry film thickness of not less than 8 mils (0.2 mm).
 - 1. Apply second coat to provide a dry film thickness of not less than 8 mils (0.2 mm), resulting in a two-coat paint system thickness of not less than 16 mils (0.4 mm).
 - 2. Apply second and third coats with each coat having a dry film thickness of not less than 8 mils (0.2 mm), resulting in a three-coat paint system thickness of not less than 24 mils (0.6 mm).
 - 3. Mark pile lengths after shop painting.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Site Conditions: Do not start pile-driving operations until earthwork fills have been completed or excavations have reached an elevation of 6 to 12 inches (152 to 305 mm) above bottom of footing or pile cap.

3.02 DRIVING EQUIPMENT

- A. Pile Hammer: Air-, steam-, hydraulic-, or diesel-powered type capable of consistently delivering adequate peak-force duration and magnitude to develop the ultimate capacity required for type and size of pile driven and character of subsurface material anticipated.

- B. Hammer Cushions and Driving Caps: Between hammer and top of pile, provide hammer cushion and steel driving cap as recommended by hammer manufacturer and as required to drive pile without damage.
- C. Leads: Use fixed or semi fixed pile-driver leads that will hold full length of pile firmly in position and in axial alignment with hammer.

3.03 DRIVING PILES

- A. General: Continuously drive piles to elevations or penetration resistance indicated or established by load testing of piles. Establish and maintain axial alignment of leads and piles before and during driving.
- B. Heaved Piles: Redrive heaved piles to tip elevation at least as deep as original tip elevation with a driving resistance at least as great as original driving resistance.
- C. Driving Tolerances: Drive piles without exceeding the following tolerances, measured at pile heads:
 - 1. Location: 4 inches (102 mm) from location indicated after initial driving, and 6 inches (152 mm) after pile driving is completed.
 - 2. Plumb: Maintain 1 inch (25 mm) in 4 feet (1.2 m) from vertical, or a maximum of 4 inches (102 mm), measured when pile is aboveground in leads.
- D. Withdraw damaged or defective piles and piles that exceed driving tolerances and install new piles within driving tolerances.
 - 1. Fill holes left by withdrawn piles using cohesionless soil material such as gravel, broken stone, and gravel-sand mixtures. Place and compact in lifts not exceeding 72 inches (1.83 m).
 - 2. Fill holes left by withdrawn piles as directed by the Geotechnical Engineer.
- E. Cutting Off: Cut off tops of driven piles square with pile axis and at elevations indicated.
- F. Pile-Driving Records: Maintain accurate driving records for each pile. Include the following data:
 - 1. Project name and number.
 - 2. Name of Contractor.
 - 3. Pile location in pile group.
 - 4. Sequence of driving in pile group.
 - 5. Pile dimensions.

6. Ground elevation.
7. Elevation of tips after driving.
8. Final tip and cutoff elevations of piles after driving pile group.
9. Records of re-driving.
10. Elevation of splices.
11. Type, make, model, and rated energy of hammer.
12. Weight and stroke of hammer.
13. Type of pile-driving cap used.
14. Cushion material and thickness.
15. Actual stroke and blow rate of hammer.
16. Pile-driving start and finish times, and total driving time.
17. Time, pile-tip elevation, and reason for interruptions.
18. Number of blows for every 12 inches (305 mm) of penetration, and number of blows per 1 inch (25 mm) for the last 6 inches (152 mm) of driving.
19. Pile deviations from location and plumb.
20. Preboring, jetting, or special procedures used.
21. Unusual occurrences during pile driving.

3.04 FROST JACKING PREVENTION

- A. The upper six feet of embedded pile should be treated as follows to mitigate the potential for seasonal frost jacking and/or downdrag. After driving, remove all soil from around and between the pile flanges to a depth of at least six feet below finish grade. Completely coat the exposed surfaces of the pile section with at least ½ inches of a food-grade grease (USDA H1), or environmentally acceptable oil/wax mix for below grade use, (Petro Star “White Calcium Grease” or equal). Next, wrap the full perimeter of the exposed pile with at least three layers of plastic sheeting. Finally, backfill the excavation around each pile, after dewatering, with a non-frost-susceptible classified material.

3.05 FIELD QUALITY CONTROL

- A. Special Inspections: The department shall engage a qualified special inspector to perform the following special inspections:
 1. Pile foundations.
 2. Welds as indicated on the drawings.

- B. Testing Agency: The contractor shall engage a qualified independent testing agency to perform pile foundation testing.
- C. Tests and Inspections:
 - 1. Dynamic Pile Testing: High-strain dynamic monitoring shall be performed and reported according to ASTM D 4945 during initial driving and during restriking on five (5) single piles.
 - 2. Weld Testing: In addition to visual inspection, welds shall be tested and inspected according to AWS D1.1/D1.1M and inspection procedures listed below, at testing agency's option. Correct deficiencies in Work that test reports and inspections indicate do not comply with the Contract Documents.
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Radiographic Inspection: ASTM E 94, minimum quality level "2-2T."
 - d. Ultrasonic Inspection: ASTM E 164.

3.06 TOUCHUP PAINTING

- A. Clean field welds, splices, and abraded painted areas and field-apply paint according to SSPC-PA 1. Use same paint and apply same number of coats as specified for shop painting.
 - 1. Apply touchup paint before driving piles to surfaces that will be immersed or inaccessible after driving.

3.07 DISPOSAL

- A. Remove withdrawn piles and cutoff sections of piles from site and legally dispose of them off Owner's property.

END OF SECTION

**SECTION 02520
PRODUCTION WATER WELLS**

PART 1 - GENERAL

1.1 SUMMARY

A. Requirements

1. Furnish labor, tools, equipment and materials for drilling, casing, screening, developing, grouting, gravel packing, and testing one production water well, anticipated to be 60 to 90 feet deep, with a minimum of 10 feet of well screen. The minimum water well yield goal is 15 gallons per minute (gpm).

B. Minimum Qualifications

1. Demonstrate a minimum of three years of experience in well drilling.
2. The well must be drilled and developed by experienced and qualified personnel.

C. General Conditions

1. Drill well at the site shown on plans or as directed by the Engineer.
2. The Engineer must be provided access to the Work to observe installation, study hydrologic and geologic conditions, collect samples, and make special tests and studies.
3. All finished work must meet the requirements for a Class A Water System under Alaska Department of Environmental Conservation (DEC) regulations.
4. The Engineer will provide an Alaska Department of Natural Resources (DNR) Temporary Water Use Permit. The Contractor is responsible for obtaining all other permits necessary for the Work, and observing all applicable codes.

D. Site Conditions and Access

1. There is a barge landing at Mertarvik, but it can only be relied upon to provide 5 or 6 feet of draft. There is a road constructed of DuraBase matting from the beach to within approximately 500 feet of where the well is to be drilled. From the end of the road to the drill site is well-drained tundra with scrubby vegetation. The drill site is accessible by rubber-tired vehicle mounted drill rigs. Travel over soft ground may be encountered.
2. It is also possible to unload and load drilling and support equipment from a landing craft or similar marine transportation on the beach.

1.2 REFERENCES

The latest revision of the following regulations, standards and publications are part of this specification. The publications may be referenced in the text by basic designation only.

A. ANSI/AWS D1.1 *Structural Welding Code - Steel*

- B. ANSI/AWS D10.12M/D10.12 *Guide for Welding Mild Steel Pipe*
- C. ANSI/AWWA A100 *Water Wells*
- D. ANSI/AWWA C206 *Field Welding of Steel Water Pipe*
- E. ANSI/AWWA C654 *Disinfection of Wells*
- F. API RP 5B1 *Recommended Practice for Gaging and Inspection of Casing, Tubing and Pipe Line Threads*
- G. ASTM A53 *Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc-Coated, Welded and Seamless*
- H. ASTM A139 *Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over)*
- I. ASTM A589 *Standard Specification for Seamless and Welded Carbon Steel Water-Well Pipe*
- J. ASTM D2487 *Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)*
- K. DEC Regulations 18 AAC 75 *Oil and Hazardous Substances Pollution Control*
- L. DEC Regulations 18 AAC 80 *Drinking Water*
- M. EPA Document 570/9-75-001 *Manual of Water Well Construction Practices*
- N. Johnson *Screens Groundwater and Wells*, Third Edition
- O. NSF/ANSI 60 *Drinking Water Treatment Chemicals - Health Effects*
- P. NSF/ANSI 61 *Drinking Water System Components - Health Effects*

1.3 SUBMITTALS AND SUBSTITUTIONS

A. Materials, Methods and Schedule

1. Before materials procurement or shipment, the Contractor must identify all proposed products and materials, and submit manufacturers' specifications, information and certifications.
2. The Contractor must have approval from the Department for proposed drilling equipment, methods, and procedures.

3. At the preinstallation conference, the Contractor must identify the proposed method of mobilization to the site and a timetable adequate to meet the construction start and completion dates and submit this to the Department for approval.

B. Daily Drilling Report

1. The Contractor must complete and submit a daily drilling report to the Engineer at the end of each working day, either in person, or by electronic mail. This requirement will begin the day the Contractor arrives on site and begins work.
2. Reports must include the following information:
 - a. Date.
 - b. Weather Conditions.
 - c. Names of Drill Crew Onsite.
 - d. Equipment Onsite.
 - e. Progress or Work Activities Performed.
 - f. Instructions Received.
 - g. Description of Significant Drilling Events Encountered.
 - h. Pay Items Achieved or Installed (Daily and Totals).

C. At the completion of the project, the Contractor must submit to the Department unbound, reproducible, and legible copies of the following records:

1. Drilling Log.
2. Particle Size Distribution Report for the gradation analysis of a soil sample from the water bearing strata.
3. DNR Water Well Log.
4. As-built well construction drawing.
5. Well development logs.
6. Yield and drawdown test pumping logs.
7. Record of plumbness and alignment.
8. Abandonment records, if performed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Material used in drilling or well construction must meet these requirements:

1. All material must be free of contaminants.
2. All chemicals, substances and materials added to or brought in contact with water in a public water system must have NSF/ANSI 60 or 61 certification.
3. All drilling mud, additives, and lubricants must have NSF/ANSI 60 certification. Drilling fluid or additives that contain biodegradable organic material shall not be used.

B. Well casing must meet these requirements:

1. New seamless or electric resistance welded steel pipe conforming to ASTM A53, Grade B, black wall, and at least standard weight or schedule 40. Casing shall be free of oil, grease or other contaminants;
2. Comply with NSF/ANSI 61 for use in a public water system;
3. Be greater than minimum wall thickness and weight when required to withstand the stresses of installation, grouting and operation, or corrosion;
4. Be legibly marked by the manufacturer on each length with the following information:
 - a. Name of the manufacturer;
 - b. Kind of pipe (continuous welded, electric resistance welded or seamless);
 - c. Weight or schedule;
 - d. Nominal or outside diameter;
 - e. Specification number;
 - f. Heat or lot number;
 - g. Certification mark that verifies compliance with NSF/ANSI 61.

C. Drive Shoe

1. If permanent steel casing is to be installed by driving methods, a manufactured drive shoe is required. Its type and weight shall be determined by the Contractor and specified in the initial materials submittal. The shoe selected must be appropriate for exposing the screen by the pull back method.

D. Well Screen

1. The well screen shall be a telescoping wire-wound, continuous slot by Johnson Screens, or approved equal. The screen shall be fabricated by circumferentially wrapping a triangular-shaped wire around a circular array of equally spaced internal rods. Each juncture between the horizontal wire and the vertical rods shall be fusion welded under water for maximum collapse strength. The wire shape must produce inlet slots with sharp outer edges, widening inwardly to minimize clogging. Screen end fittings shall be securely welded to each section.
2. The well screen and its fittings shall be fabricated from Type 304 stainless steel.
3. The well screen shall provide sufficient column and collapse strength to withstand installation and borehole pressures.
4. The screen shall be installed with a closed bail bottom and a self-sealing neoprene packer top which shall provide a sand-tight seal. The bottom and the packer shall be made by the same manufacturer as the screen.
5. A manufacturer's certification of materials shall be provided to the Department.

E. Gravel Pack

1. The gravel pack, if necessary, shall meet requirements of ANSI/AWWA A100 Section 4.6.

F. Sanitary Well Seal

1. The sanitary well seal shall be a Campbell cast iron pitless well seal, Catalog No. S8, or approved equal.
2. The seal shall be designed to provide a watertight, non-ventilating seal of the well casing top, provide watertight entry of pump electrical service and allow easy removal of a pump without disconnection of electrical service.

PART 3 - EXECUTION

3.1 STAGING AND CONSTRUCTION SITES

- A. The Contractor shall be responsible for the overall care of property used to stage materials and equipment, and the drilling site. Fuel, oil, hydraulic fluid and other petroleum or combustible products must be stored and maintained in compliance with manufacturers' instructions and an approved site plan.
- B. All equipment owned by the Contractor must be kept in good repair at all times. All powered equipment and drill rigs must be inspected before and after each use for any fuel, hydraulic oil or coolant leaks. The use of powered equipment with known leaks is prohibited. Site clean-up of any accidental petroleum leaks or spills are the responsibility of the Contractor and shall be remediated immediately upon discovery. Any spill,

regardless of size, must be reported to the Department as soon as practical. In addition, the Contractor shall comply with all requirements of the Alaska Department of Environmental Conservation (DEC), according to 18 AAC 75.

- C. Refueling or other fluid handling activities may have special restrictions in sensitive areas. An adequate supply of absorbent pads must be kept onsite to facilitate initial remediation of small petroleum spills.

3.2 DRILLING

- A. The well shall be constructed, developed, and tested according to ANSI/AWWA A100.
- B. The well shall be drilled without the use of drilling mud or other similar materials unless approved by the Department.
- C. The well casing shall extend continuously to the screened intake within the aquifer. The casing stickup of the completed well shall be between three and four feet above ground level.
- D. Well depth indicated is an estimate of probable required depth and will be used only as a guide and not a Contract minimum or maximum.
- E. The Contractor must keep a complete and accurate drilling log of all drilling, development, and testing activities that includes the following information:
 - 1. The geographic location of the well (latitude and longitude).
 - 2. Method of construction.
 - 3. Types of fluids used for drilling.
 - 4. The reference point for all depth measurements.
 - 5. The ease or difficulty of drilling.
 - 6. The depth at which each change of formation, stratum, or feature occurs.
 - 7. The thickness of each stratum.
 - 8. The identification of each stratum and its essential characteristics.
 - 9. The depth at which water is encountered.
 - 10. The depth interval from which each water and formation sample was taken.

11. The depth at which hole diameters (bit sizes) change.
12. The depth to the static water level (SWL) and changes in it with well depth.
13. Total depth of the completed well.
14. A detailed description of any water samples taken.
15. Depth or location of any lost drilling fluids, drilling materials, or tools.
16. The depth of the surface seal.
17. The depth of the well casing.
18. The description and location of well screens, or number, size and location of perforations.
19. Well development method.
20. Maximum well yield.

3.3 PROTECTION OF WATER QUALITY

- A. Take all precautions necessary or required to permanently prevent contaminated water, or water having undesirable physical or chemical characteristics from entering through or around the well bore or into the stratum from which the well is to draw its supply.
- B. Take all necessary precautions to prevent contaminated water, fuel, or other contaminants from entering the well either through the opening or by seepage through the ground surface.
- C. If the well becomes contaminated or water having undesirable physical or chemical characteristics enters the well due to neglect of the Contractor, it shall, at its own expense, perform such Work and supply such casings, seals, sterilizing agents or other material as necessary to eliminate the contamination and to shut off the undesirable water.

3.4 SAMPLING OF FORMATION

- A. Collect representative samples at measured depths and at intervals that will show the complete lithologic character of the formations penetrated.
- B. Collect samples at a maximum of 10-foot intervals and at every change in formation materials. Collect samples at 5-foot intervals in all potential aquifers.
- C. Samples must not be washed, and must be kept in securely sealed containers labeled with the well identification, date and depth from which

the sample was taken. Samples must contain a minimum of 1 quart of solids representative of the formation.

3.5 JOINING STEEL WELL CASING

- A. Casing sections shall be welded or threaded to form structurally sound and watertight joints.
1. Welding procedures shall be according to ANSI/AWS D10.12M/D10.12 for plain end well casing pipe 8 inches nominal pipe size or less, and with wall thickness up to 0.5 inch; or ANSI/AWWA C206.
 2. Well couplings must have a design, taper, and type of thread consistent with the thread of the pipe. No more than three threads shall be exposed on the fourteen-thread pipe and no more than two threads shall be exposed on the eight-thread pipe. Threaded pipe and couplings must meet ASTM A53, ASTM A5896, or API RP 5B1.

3.6 GRADATION ANALYSIS

- A. A gradation analysis of a soil sample collected from the water bearing stratum at a depth corresponding to the depth of the well screen shall be conducted according to ASTM D2487. Communicate about the results of the analysis with the well screen manufacturer to determine the appropriate well screen slot size and determine possible gravel pack requirements.
- B. Soil samples may be analyzed in the field if the Contractor has appropriate sieves and a scale. The Contractor shall also be responsible for submitting the soil sample to a laboratory for a confirmation analysis, laboratory costs, and providing a copy of the analysis report, drilling log, and notes to the well screen manufacturer.

3.7 WELL SCREEN

- A. Well screen slot sizing may be determined after Contractor communication with the screen manufacturer following a review of the sieve analysis, well driller's notes, comments, and drilling log. The Contractor must secure well screen manufacturer recommendations for screen length, design and placement in the aquifer. If a gravel (filter) pack is advised, the screen manufacturer will determine the recommended packing material to be used and appropriate screen slot sizing.

3.8 GRAVEL PACK

- A. A gravel (filter) pack shall generally be installed where the formation is non-homogeneous, the uniformity coefficient of the aquifer formation is less than 3.0, and the effective grain size is less than 0.01 inches. Filter

pack or formation stabilizer installed in unconsolidated or incompetent formations must be placed according to these specifications and/or the well screen manufacturer's recommendations:

1. Gravel pack shall extend a minimum of 20 feet above the screen. Filter pack or formation stabilizer shall be at least 25 feet below ground surface.
2. Gravel pack shall be no less than 3-inches thick and no more than 8-inches thick to facilitate proper well development.
3. Gravel pack effective grain size shall be determined by a sieve analysis of the aquifer formation.
4. If installed, gravel pack refill pipes shall be standard weight steel or plastic pipe and terminate with screwed or welded caps at least 2 feet above the original ground elevation. Refill pipes shall pass through the grouted annular space where they shall be surrounded by a minimum of 1.5-inches of grout.

3.9 GROUTING

- A. The well casing must be grouted with a watertight cement grout, sealing clay, bentonite, or equivalent material. Before proceeding with placing the grout, the Contractor shall secure the Department's approval of the method it proposes to use.
- B. The grout seal shall be continuous between 10 feet and 20 feet below grade. At the direction of the Department, this distance may be increased where necessary to provide increased protection of the water supply.

3.10 PLUMBNESS AND ALIGNMENT

- A. Exercise such care as is necessary to keep the well straight and plumb. The completed well must meet plumbness and alignment maximum tolerances in ANSI/AWWA A100 Section 4.7.9. Variations that could affect operation will not be accepted.
- B. The Contractor may be required to run a test for plumbness and alignment on questionable wells at the request of the Department. The test procedure used is described in Appendix C of ANSI/AWWA A100. Records of deflection readings and all other pertinent information must be kept and made a part of the permanent well log record.
- C. If the test shows that the well does not meet the criteria for plumbness and alignment, the well may be rejected with no payment to the Contractor, until the deficiency is corrected to the Department's satisfaction.

3.11 WELL DEVELOPMENT

- A. Determine the most effective method(s) for development of each well to:
 - 1. Remove formation damage caused by borehole drilling, and
 - 2. Establish the optimal hydraulic interface between the well and the aquifer supplying the water.
- B. At initial completion and final development, water pumped from the well must be free of residues from drilling fluid, grout and any chemicals used in development. Development shall proceed until these conditions are met.
- C. Determine when well development is complete. To consider the well acceptable, water quality and the specific capacity of the well must be evaluated. For final well development determinations, pumped water shall:
 - 1. Have a total sediment content of less than 5 mg/L, measured with a Rossum sand tester, and
 - 2. Turbidity of less than 1 NTU.

If these standards cannot be attained, the Contractor must initiate an evaluation process with the Department.

- D. Keep accurate and detailed records of development.

3.12 TESTING FOR YIELD AND DRAWDOWN

- A. Furnish all labor, equipment, materials, and power required for test pumping, to the satisfaction of the Department. This shall include all necessary equipment for measuring the water level in the well and the rate of pump discharge. The test pump shall have a minimum capacity of at least 150 percent of the target flow rate. The Contractor must obtain the Department's approval of this equipment before test pumping.
- B. Furnish all necessary piping for conducting the water away from the test site to a suitable location approved by the Department.
- C. Conduct a step-drawdown test to determine the general parameters for a constant rate pumping test. Pump the well at a minimum of at least three progressively increasing rates, with the length of each discharge step long

enough to indicate a straight-line plot trend of drawdown versus logarithm of time since pumping began.

- D. After the step-drawdown test, allow the well to recover until the water level returns to approximately static conditions. After recovery, conduct a constant-rate test at a designated capacity to determine the trend of drawdown versus prolonged time of pumping at the pumped well.
- E. The duration of the constant-rate test pumping shall be until the pumping water level stabilizes or 24 hours, whichever is longer. After pumping is stopped, water levels will be taken until the water level reaches the original static water level or for four hours, whichever is shorter. Take measurements at the following intervals:

<u>Test Pumping Time</u>	<u>Drawdown Recording Interval</u>
1 - 5 minutes	1 minute
5 - 30 minutes	5 minutes
30 - 90 minutes	10 minutes
90 minutes - end of test	30 minutes
<u>Time from Termination of Pumping</u>	<u>Recovery Recording Interval</u>
1 - 5 minutes	1 minute
5 - 30 minutes	5 minutes
30 - 90 minutes	10 minutes
90 minutes - end of test	30 minutes

- F. Record and maintain test data regarding water levels, pumping rates, time intervals, and other pertinent details on the drilled well.

3.13 DISINFECTION

- A. Upon well completion, disinfect the well according to AWWA C654 *Disinfection of Wells*. Following disinfection with a chlorine compound, water pumped from the well must be de-chlorinated before final disposal.
- B. Following disinfection, collect a water sample and send to a DEC-certified laboratory for bacteriological analysis. The Contractor is responsible for the collection, submittal, and analysis costs of water samples for confirmation of disinfection success.

- C. If the water sample is positive for total coliform, disinfection must be repeated.
- D. Install a sanitary well seal following disinfection.

3.14 WATER QUALITY SAMPLING AND ANALYSIS

- A. Assist the Department with the collection of water quality samples for field testing and laboratory analysis.
- B. The Department will be responsible for sample containers, conducting water quality field tests, and the submittal and laboratory analysis of water samples, other than bacteriological.

3.15 WELL ABANDONMENT

- A. If the well will not produce adequate capacity, has unsatisfactory chemical or bacteriological quality; or must be abandoned because of poor alignment, loss of tools, or for any other cause, the Department may choose to abandon the well and drill in another location. If abandonment is because of unsatisfactory workmanship by the Contractor, no payment will be made for this Bid Item.
- B. If the well is not accepted for completion, the abandoned hole must be filled with clay, concrete, grout or neat cement to a standard acceptable to DEC.
- C. The abandoned well casing shall be cut and capped 4 feet below grade and covered with a minimum of 2 cubic feet of concrete or ample and well distributed bentonite to meet DEC standards before backfilling to original grade.
- D. Record information on an abandoned well according to ANSI/AWWA A100 Section 4.10.

3.16 SITE GRADING

- A. Upon completion of all Work, slope or contour the ground surface for 10 feet in all directions from the well so surface flow will drain away from the well.

END OF SECTION 02520

SECTION 02820

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Chain-link fences.
 - 2. Gates: Swing.

1.03 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design chain-link fences and gates, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Chain-link fence and gate framework shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
- C. Lightning Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.
- D. Perimeter building fencing to prevent unauthorized access to under-building areas.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.
 - 1. Fence and gate posts, rails, and fittings.
 - 2. Chain-link fabric, reinforcements, and attachments.

3. Gates and hardware.
 - B. Delegated-Design Submittal: For chain-link fences and gate framework indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of chain-link fence, and gate, from manufacturer.
- B. Product Test Reports: For framing strength according to ASTM F 1043.

1.06 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing fence grounding. Member company of NETA or an NRTL.
 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.07 PROJECT CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.01 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:
 1. Fabric Height: As indicated on Drawings.
 2. Steel Wire Fabric: 9 gauge.
 - a. Mesh Size: 2 .
 - b. Zinc-Coated Fabric: ASTM A 392, Type II, Class 1, 1.2 oz./sq. ft., with zinc coating applied before or after weaving.

- c. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.
3. Selvage: Twisted top and knuckled bottom.

2.02 FENCE FRAMING

- A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:
 1. Fence Height: As indicated on Drawings.
 2. Heavy Industrial Strength: Material Group IA, round steel pipe, Schedule 40.
 - a. Line Post: 2.375 in diameter.
 - b. End, Corner and Pull Post: 2.875 in diameter.
 3. Horizontal Framework Members: Top rails complying with ASTM F 1043.
 - a. Top Rail: 1.66 inches in diameter.
 4. Brace Rails: Comply with ASTM F 1043.
 5. Metallic Coating for Steel Framing:
 - a. Type A, consisting of not less than minimum 2.0-oz./sq. ft. average zinc coating per ASTM A 123/A 123M.

2.03 TENSION WIRE

- A. Metallic-Coated Steel Wire: 0.177-inch- diameter, marcelled tension wire complying with ASTM A 817 and ASTM A 824, with the following metallic coating:
 1. Type II, zinc coated (galvanized) by hot-dip process, with the following minimum coating weight:
 - a. Matching chain-link fabric coating weight.

2.04 SWING GATES

- A. General: Comply with ASTM F 900 for gate posts and single swing gate types.
 1. Gate Leaf Width: As indicated.
 2. Gate Fabric Height: As indicated.

- B. Pipe and Tubing:
 - 1. Zinc-Coated Steel: Comply with ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framing.
 - 2. Gate Posts: Round tubular steel.
 - 3. Gate Frames and Bracing: Round tubular steel.
- C. Frame Corner Construction: Assembled with corner fittings.
- D. Hardware:
 - 1. Hinges: 360-degree inward and outward swing.
 - 2. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.

2.05 FITTINGS

- A. General: Comply with ASTM F 626.
- B. Post Caps: Provide for each post.
 - 1. Provide line post caps with loop to receive tension wire or top rail.
- C. Rail and Brace Ends: For each gate, corner, pull, and end post.
- D. Rail Fittings: Provide the following:
 - 1. Rail Clamps: Line and corner boulevard clamps for connecting intermediate rails in the fence line-to-line posts.
 - 2. Top Rail Sleeves: Round steel tubing not less than 6 inches long.
- E. Tension and Brace Bands: Pressed steel.
- F. Tension Bars: Steel, length not less than 2 shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.
- G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

2.06 FENCE GROUNDING

- A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
 - 1. Material above Finished Grade: Copper.
 - 2. Material on or below Finished Grade: Copper.

3. Bonding Jumpers: Braided copper tape, 1 wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.
- B. Connectors and Grounding Rods: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 467.
 1. Connectors for Below-Grade Use: Compression connectors.
 - a. Tools and dies of types recommended by manufacturer for materials being joined and installation conditions.
 - b. Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
 2. Grounding Rods: Copper-clad steel, 3/4 inch by 10 feet.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for earthwork.
 1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Indicate locations of utilities.

3.03 INSTALLATION, GENERAL

- A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.
 1. Install fencing on established boundary lines inside property line.

2. Install fencing where necessary to prevent unauthorized under-building access.

3.04 CHAIN-LINK FENCE INSTALLATION

- A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- B. Post Setting: Set gate and corner posts in concrete and line posts by mechanically driving into soil at indicated spacing into firm, undisturbed soil.
 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 2. Mechanically Driven Posts: Drive into soil to depth indicated on Drawings. Protect post top to prevent distortion.
- C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal alignment as indicated on Drawings.
- D. Line Posts: Space line posts uniformly at maximum of 10 o.c.
- E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
 1. Locate horizontal braces at midheight of fabric 72 or higher, on fences with top rail and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- F. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:
 1. Extended along top and bottom of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 of bottom of fabric and tie to each post with not less than same diameter and type of wire.
- G. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

- H. Intermediate and Bottom Rails: Install and secure to posts with fittings.
- I. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2 between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 o.c.
- K. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
 - 1. Maximum Spacing: Tie fabric to line posts at 12 o.c. and to braces at 24 o.c.
- L. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.
- M. For under-building fencing, brace panels in such a way that they cannot be pushed aside to gain access. Attach fencing to perimeter of building so that entire soffit area is protected. In order to prevent distortion due to shifting substrate, do not attach fencing to the ground in these areas.

3.05 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.
- B. Gates shall be installed at all under-building fencing to allow access by authorized personnel. Coordinate location with Owner. In other respects gates shall conform to other requirements of under-building fencing.

3.06 GROUNDING AND BONDING

- A. Fence Grounding: Install at maximum intervals of except as follows:
 - 1. Gates and Other Fence Openings: Ground fence on each side of opening.
 - a. Bond metal gates to gate posts.

SECTION 05120
STRUCTURAL STEEL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Structural steel.
- B. Related Sections:
 - 1. Section 05310 "Steel Deck" for field installation of shear connectors through deck.
 - 2. Section 05511 "Metal Stairs."
 - 3. Section 09911 "Exterior Painting," Section 09912 "Interior Painting" for surface-preparation and priming requirements.

1.03 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.04 PERFORMANCE REQUIREMENTS

- A. Construction: Braced frame

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Inspection Agency: Qualification data, as required, for quality assurance inspections.
- C. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 - 3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
 - 4. Identify members and connections of the seismic-load-resisting system.
- D. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer, Fabricator, Inspection Agency, and Testing Agency.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.07 QUALITY ASSURANCE

- A. Fabricator Qualifications: Contractor shall provide one of the following:
 1. A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
 2. An independent Inspection Agency to provide continuous inspection during fabrication. Contractor shall submit inspection agency qualification data, and receive Department approval, prior to engaging inspection services.
- B. Installer Qualifications: Contractor shall provide one of the following:
 1. A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector.
 2. An independent Inspection Agency to provide continuous inspection during installation. Contractor shall submit inspection agency qualification data, and receive Department approval, prior to engaging inspection services.
- C. Shop-Painting Applicators: Contractor shall provide one of the following:
 1. Qualified according to AISC's Sophisticated Paint Endorsement or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."
 2. An independent Inspection Agency to provide continuous inspection during shop-painting applications. Contractor shall submit inspection agency qualification data, and receive Department approval, prior to engaging inspection services.
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
- E. Comply with applicable provisions of the following specifications and documents:
 1. AISC 303.
 2. AISC 341 and AISC 341s1.
 3. AISC 360.
 4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

- F. Preinstallation Conference: Conduct conference at a time and location determined by the Department.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.09 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.01 STRUCTURAL-STEEL MATERIALS

- A. Channels and Angles Shapes: ASTM A 36/A 36M
- B. Plate and Bar: ASTM A 36/A 36M
- C. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
 - 1. Weight Class: As indicated on the drawings.
 - 2. Finish: Galvanized.
- D. Welding Electrodes: Comply with AWS requirements.

2.02 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.

2.03 PRIMER

- A. Primer: SSPC-Paint 25, Type II, zinc oxide, alkyd, linseed oil primer.
- B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.04 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
 1. Camber structural-steel members where indicated.
 2. Fabricate beams with rolling camber up.
 3. Mark and match-mark materials for field assembly.
 4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- C. Finishing: Accurately finish ends of members transmitting bearing loads.
- D. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.

2.05 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.06 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
 2. Surfaces to be field welded.
 3. Surfaces to be high-strength bolted with slip-critical connections.
 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).

5. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 1. SSPC-SP 3, "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.07 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
 1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.

2.08 SOURCE QUALITY CONTROL

- A. Testing Agency: The Department will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 1. Liquid Penetrant Inspection: ASTM E 165.
 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 3. Ultrasonic Inspection: ASTM E 164.
 4. Radiographic Inspection: ASTM E 94.

- E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - 1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
 - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.03 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- C. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- D. Splice members only where indicated.
- E. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.04 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt.
- B. Retain option in paragraph below for "High-Seismic Applications" as defined in AISC 360.
- C. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 - 3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.05 FIELD QUALITY CONTROL

- A. Testing Agency: The Department will engage a qualified independent testing and inspecting agency to inspect field welds.
- B. Bolted Connections: Bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

- E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.06 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.
- B. Touchup Painting: Cleaning and touchup painting are specified in Section 09911 "Exterior Painting" and Section 09912 "Interior Painting."

END OF SECTION

SECTION 05310

STEEL DECK

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Roof deck.
- B. Related Requirements:
 - 1. Division 9 painting Sections for repair painting of primed deck and finish painting of deck.

1.03 ACTION SUBMITTALS

- A. Shop Drawings:
 - 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.04 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of steel deck.
- B. Field quality-control reports.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Retain "Welding Qualifications" Paragraph below if shop or field welding is required. If retaining, also retain "Welding certificates" Paragraph in "Informational Submittals" Article. AWS states that welding qualifications remain in effect indefinitely unless welding personnel have not welded for more than six months or there is a specific reason to question their ability.

- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."
- D. Retain "Electrical Raceway Units" Paragraph below if using cellular floor-deck systems as raceways.
- E. Retain "FM Global Listing" Paragraph below if FM Global compliance is required for roof deck. Several manufacturers have products listed in FM Global's "Approval Guide, Building Materials."
- F. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

2.02 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.
- D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

- E. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Coordinate reinforcing requirements of openings in first paragraph below with other Division 5 Sections.
- H. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- I. Retain paragraph below if mechanical fastening is permitted.
- J. Mechanical fasteners shall be used to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.03 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to Glued Laminated Timber supporting members as indicated on the construction document drawings.

- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or [18 inches (457 mm)] [36 inches (914 mm)], and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
- D. Retain one of three options in "End Joints" Subparagraph below. SDI allows lapped or butted ends for roof deck. FM Global recommends that ends lap a minimum of 2 inches (51 mm).
- E. End Joints: Lapped 2 inches (51 mm) minimum.
- F. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Mechanically fasten to substrate to provide a complete deck installation. There shall be no change in metal deck orientation.
- G. Retain "Flexible Closure Strips" Paragraph below if flexible closures are required or permitted. Usually delete if fire-resistance-rated partitions are required.
- H. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.04 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Testing agency will report inspection results promptly and in writing to Contractor and Owner's Representative.
- C. Remove and replace work that does not comply with specified requirements.
- D. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.05 PROTECTION

- A. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05511

MISCELLANEOUS METALS

PART 1 - GENERAL

1.01 CONTRACT CONDITIONS

- A. Work of this section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and Accompanying Drawings.

1.02 EXTENT OF WORK

- A. This Section includes exterior Stair Treads, Gratings, Handrail, Guardrails and related materials.

1.03 RELATED SECTIONS\

05120 Structural Steel

1.04 PERFORMANCE REQUIREMENTS

- A. Reference Structural Drawings.

1.05 SUBMITTALS

- A. Product data including loading criteria for proposed product application.
- B. Quantity, size, and gauge confirmation.
- C. Attachment Details.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating, structural steel, Grade 33 (Grade 230), unless another grade is required by design loads.

2.1 STEEL STAIR TREADS AND DECKING

- A. Grip Strut Grating and Stair Treads by McNichols or equal.
 - 1. Grip Strut Safety Grating or Equal: 12 gauge steel and a depth of 3-inches.
 - 2. Typical Decking: 5 diamond 11 3/4" wide.

3. Stair Tread with integral riser: 5 diamond 11 3/4" wide with end closure plates for attachment to stringers. Riser special formed with tread.
4. Fasteners: Diamond Anchor for 5/16" diameter bolt or lag screw.
5. End Kick Plates: Provide End Kick Plates (14 gauge) and kick plate clips for all openings between stair treads.

2.2 STAIR RAILINGS

- A. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
 1. Rails and Posts: 2" square top and bottom rails and 2" square posts. Galvanized.
 2. Handrail: 1-1/4" pipe railing, schedule 40, Galvanized. Galvanized brackets attaching to posts and interior walls.
 3. Mesh Infill: Woven wire mesh crimped into 2-by-2-by-.135 Steel Gauge Galvanized

2.3 METAL HOOD COVER

- A. Metal Hood Cover: Galvanized Steel Sheet, 18 Gauge, coated per 09990 paints.

2.4 COUNTER SUPPORTS

- A. Counter Supports: 2" Welded Tubular Steel, 18" x 18", painted.

2.5 WIND DEFLECTOR

- A. Metal Cover: Galvanized Steel Sheet, 16 Gauge, coated per 09990 paints.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rac

3.2 INSTALLING RAILINGS

- A. Retain this article only for steel tube railings specified in this Section.

1. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
 - a. Anchor posts to steel by welding directly to steel supporting members.
- B. Attach handrails to wall with wall brackets. Use type of bracket with predrilled hole for exposed bolt anchorage. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:
 1. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.

3.2 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas.
- B. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
- C. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.

END OF SECTION

SECTION 06100
ROUGH CARPENTRY

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Framing with dimension lumber.
 - 2. Framing with engineered wood products.
- B. Related Requirements:
 - 1. Division 6 Section "Sheathing."

1.03 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NLGA: National Lumber Grades Authority.
 - 2. WCLIB: West Coast Lumber Inspection Bureau.
 - 3. WWPA: Western Wood Products Association.

1.04 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. In DOC PS 20, dressed sizes of green lumber are larger than dry lumber.
 - 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 - 4. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent.
- C. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
 - 1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.02 DIMENSION LUMBER FRAMING

- A. All dimensional lumber framing properties: As indicated on the drawings.

2.03 ENGINEERED WOOD PRODUCTS

- A. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.
- B. Wood I-Joists: Prefabricated units, I-shaped in cross section, made with solid or structural composite lumber flanges and wood-based structural panel webs, let into and bonded to flanges. Provide units complying with material requirements of and with structural capacities established and monitored according to ASTM D 5055.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Boise Cascade Corporation.
 - b. Roseburg Forest Products Co.
 2. Web Material: Either oriented strand board or plywood, complying with DOC PS 1 or DOC PS 2, Exposure 1.
 3. Structural Properties: Provide units with depths and design values not less than those indicated.
 4. Provide units complying with APA PRI-400, factory marked with APA trademark indicating nominal joist depth, joist class, span ratings, mill identification, and compliance with APA standard.
- C. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Boise Cascade Corporation.
 - b. Roseburg Forest Products Co.
 2. Extreme Fiber Stress in Bending, Edgewise: As indicated on the drawings.
 3. Modulus of Elasticity, Edgewise: As indicated on the drawings.

2.04 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. NES NER-272 covers power-driven staples, nails, P-nails, and allied fasteners.
- D. Power-Driven Fasteners: NES NER-272.
- E. Wood Screws: ASME B18.6.1.
- F. Lag Bolts: ASME B18.2.1.

- G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- C. Do not splice structural members between supports unless otherwise indicated.
- D. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- E. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- F. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
- G. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.02 WALL AND PARTITION FRAMING INSTALLATION

- A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness, unless noted otherwise, whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction unless otherwise indicated.

- B. Construct corners and intersections with three or more studs, except that two studs may be used for interior non-load-bearing partitions.
- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
 - 1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.
 - 2. For load-bearing walls, provide members as indicated.

3.03 FLOOR JOIST FRAMING INSTALLATION

- A. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal. Attach floor joists as follows:
 - 1. Where supported on wood members, by using metal framing anchors.
 - 2. Where framed into wood supporting members, by using wood ledgers as indicated or, if not indicated, by using metal joist hangers.
- B. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches.
- C. Do not notch in middle third of joists; limit notches to one-sixth depth of joist, one-third at ends. Do not bore holes larger than 1/3 depth of joist; do not locate closer than 2 inches from top or bottom.
- D. Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches or securely tie opposing members together. Provide solid blocking of 2-inch nominal thickness by depth of joist over supports.
- E. Provide solid blocking between joists under jamb studs for openings.
- F. Under non-load-bearing partitions, provide double joists separated by solid blocking equal to depth of studs above.
 - 1. Provide triple joists separated as above, under partitions receiving ceramic tile and similar heavy finishes or fixtures.
- G. Provide bridging of type indicated below, at intervals of 96 inches o.c., between joists.

1. Diagonal wood bridging formed from bevel-cut, 1-by-3-inch nominal- size lumber, double-crossed and nailed at both ends to joists.
2. Steel bridging installed to comply with bridging manufacturer's written instructions.

3.04 CEILING JOIST FRAMING INSTALLATION

- A. Ceiling Joists: Install ceiling joists with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.
 1. Where ceiling joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate and nail to first joist or anchor with framing anchors or metal straps. Provide 1-by-8-inch nominal- size or 2-by-4-inch nominal- size stringers spaced 48 inches o.c. crosswise over main ceiling joists.

3.05 STAIR FRAMING INSTALLATION

- A. Provide stair framing members of size, space, comply with the following requirements:
 1. Size: as indicated.
 2. Material: as indicated
 3. Notching: Notch rough carriages to receive treads, risers, and supports; leave at least 3-1/2 inches of effective depth.
 4. Spacing: At least three framing members for each 36-inch clear width of stair.
- B. Provide stair framing with no more than 3/16-inch variation between adjacent treads and risers and no more than 3/8-inch variation between largest and smallest treads and risers within each flight.

3.06 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes sufficiently wet that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- C.

END OF SECTION

SECTION 06160
SHEATHING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Subflooring.
- B. Related Requirements:
 - 1. Division 6 Section "Rough Carpentry" for plywood backing panels.
 - 2. Division 7 Section "Weather Barriers" for water-resistive barrier applied over wall sheathing.

1.03 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" Or GA-600, "Fire Resistance Design Manual."

2.02 WOOD PANEL PRODUCTS

- A. Retain one of two options in "Plywood" Paragraph below, usually the second. DOC PS 2 is a performance-based standard that does not include requirements for grades of veneers. Second option includes phrase "unless otherwise indicated" to allow for underlayment that is specified to comply with DOC PS 1 because a minimum face veneer grade is required; delete if phrase is not needed.
- B. Plywood: DOC PS 1.
- C. Retain "Thickness" Paragraph below if a minimum thickness is shown on Drawings.
- D. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- E. Factory mark panels to indicate compliance with applicable standard.

2.03 SUBFLOORING AND UNDERLAYMENT

- A. Plywood Subflooring: Exposure 1 single-floor panels or sheathing.
 - 1. Span Rating: Not less than 24o.c.
 - 2. Nominal Thickness: As indicated on the drawings.

2.04 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Standard in "Power-Driven Fasteners" Paragraph below covers power-driven staples, nails, P-nails, and allied fasteners.
- D. Power-Driven Fasteners: NES NER-272.
- E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

2.05 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Framing: Formulation complying with [APA AFG-01] [ASTM D 3498] that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Retain one of two subparagraphs below, with or without subparagraph above, to comply with requirements of Project and local codes.
 - 3. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
 - 4. Table R602.3 (1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."
- D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.02 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

- B. Fastening Methods: Fasten panels as indicated below:
1. Subflooring:
 - a. Glue and nail to wood framing.
 - b. Space panels 1/8 inch (3 mm) apart at edges and ends.

END OF SECTION

SECTION 06185

STRUCTURAL GLUED-LAMINATED TIMBER

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes framing using structural glued-laminated timber.
- B. Related Sections:
 - 1. 05120 Structural Steel
 - 2. 05310 Steel Deck
 - 3. 06100 Rough Carpentry
 - 4. 06260 Sheathing

1.03 DEFINITIONS

- A. Structural Glued-Laminated (Glulam) Timber: An engineered, stress-rated timber product assembled from selected and prepared wood laminations bonded together with adhesives and with the grain of the laminations approximately parallel longitudinally.

1.04 ACTION SUBMITTALS

- A. Shop Drawings:
 - 1. Show layout of structural glued-laminated timber system and full dimensions, including curvature, change in curvature locations, and splice locations not indicated on the drawings, for each member.
 - 2. Indicate species and laminating combination, adhesive type, and other variables in required work. Include size of laminations.
 - 3. Include large-scale details of connections. Min scale: 1 ½"=1'-0".

1.05 INFORMATIONAL SUBMITTALS

- A. Certificates of Conformance: Issued by a qualified testing and inspecting agency indicating that structural glued-laminated timber complies with requirements in AITC A190.1.
- B. Material Certificates: For preservative-treated wood products, from manufacturer. Indicate type of preservative used and net amount of preservative retained.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provide factory-glued structural units produced by an AITC- or APA-licensed firm.

1. Factory mark each piece of structural glued-laminated timber with AITC Quality Mark or APA-EWS trademark. Place mark on surfaces that will not be exposed in the completed Work.
- B. Quality Standard: Comply with AITC A190.1.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. General: Comply with provisions in AITC 111.
- B. Individually wrap members using plastic-coated paper covering with water-resistant seams.

PART 2 PRODUCTS

2.01 STRUCTURAL GLUED-LAMINATED TIMBER

- A. General: Provide structural glued-laminated timber that complies with AITC 117 or research/evaluation reports acceptable to authorities having jurisdiction.
 1. Provide structural glued-laminated timber made from single species.
 2. Provide structural glued-laminated timber made from solid lumber laminations; do not use laminated veneer lumber.
 3. Provide structural glued-laminated timber made with wet-use adhesive complying with AITC A190.1.
- B. Species and Grades for Structural Glued-Laminated Timber: Any species that complies with beam stress classifications indicated on the drawings.
- C. Appearance Grade:
 1. Architectural for exposed members, complying with AITC 110.
 2. Structural for concealed members, complying with AITC 110.
 3. For Architectural appearance grade, fill voids as required by AITC 110.
- D. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.
- E. Basis of Design: Boise Glulam Series – Boise Cascade LLC.

2.02 TIMBER CONNECTORS

- A. General: As indicated in 05120 Structural Steel Specification.

2.03 FABRICATION

- A. Camber: Fabricate horizontal and inclined members of less than 1:1 slope with either circular or parabolic camber equal to 1/500 of span.
- B. End-Cut Sealing: Immediately after end cutting each member to final length, apply a saturation coat of end sealer to ends and other cross-cut surfaces, keeping surfaces flood coated for not less than 10 minutes.

2.04 FACTORY FINISHING

- A. Clear Finish: Manufacturer's standard, two-coat, clear varnish finish; resistant to mildew and fungus.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates in areas to receive structural glued-laminated timber, with installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of structural glued-laminated timber.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Erect structural glued-laminated timber true and plumb, and with uniform, close-fitting joints. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.
 - 1. Lift with padded slings and protect corners with wood blocking.
 - 2. Install structural glued-laminated timber to comply with Shop Drawings.
 - 3. Install timber connectors as indicated.
- B. Fit structural glued-laminated timber by cutting and restoring exposed surfaces to match specified surfacing and finishing.
 - 1. Predrill for fasteners using timber connectors as templates.
 - 2. Dress exposed surfaces as needed to remove planing and surfacing marks.
 - 3. Coat cross cuts with end sealer.

3.03 ADJUSTING

- A. Repair damaged surfaces and finishes after completing erection. Replace damaged structural glued-laminated timber if repairs are not approved by the Department.

3.04 PROTECTION

- A. Do not remove wrappings on individually wrapped members until they no longer serve a useful purpose including protection from weather, sunlight, soiling, and damage from work of other trades.
 - 1. Coordinate wrapping removal with finishing work specified in Division 9. Retain wrapping where it can serve as a painting shield.
 - 2. Slit underside of wrapping to prevent accumulation of moisture inside the wrapping.

END OF SECTION

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SECTION 06200

FINISH CARPENTRY

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Finish carpentry items including
- B. Wood veneer panels
- C. Wood casings, trims, base trims and moldings.
- D. Fabric Tape at panel joint reveals.
- E. Hardware and attachment accessories.

1.02 REFERENCES

- A. AHA A135.4 - Basic Hardboard; American Hardboard Association; 2004.
- B. ANSI A208.1 - American National Standard for Particleboard; 1999.
- C. ASTM C 1048 - Standard Specification for Heat-Treated Flat Glass--Kind HS, Kind FT Coated, and Uncoated Glass; 2004.
- D. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2004.
- E. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; 2003.
- F. BHMA A156.9 - American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association; 2003 (ANSI/BHMA A156.9).
- G. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2000.

1.03 SUBMITTALS

- A. Product Data:
 - 1. Provide data on fire retardant treatment materials and application instructions.

2. Provide instructions for attachment hardware, finish hardware.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, accessories, to a minimum scale of 1-1/2 inch to 1 ft (1:8).

1.05 QUALITY ASSURANCE

A. Perform work in accordance with AWI Architectural Woodwork Quality Standards Illustrated, Custom grade.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Protect work from moisture damage.

1.08 PROJECT CONDITIONS

A. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

B. Coordinate the work with plumbing rough-in, electrical rough-in, installation of associated and adjacent components, and theatrical equipment.

PART 2 - PRODUCTS

2.01 LUMBER MATERIALS

A. Hardwood Lumber Trim: Maple species, Rotary sawn, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.

2.02 WOOD VENEER PANELS

A. Hardwood Plywood: Veneer core, type of glue recommended for application; Birch face species, Rotary cut.

2.03 ADHESIVE

A. Adhesive: Type recommended by laminate manufacturer to suit application.

2.04 FASTENERS

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

2.05 ACCESSORIES

A. Lumber for Shimming, Blocking,: Softwood lumber of fir species.

- B. Safety Glass: ASTM C 1048, fully tempered; clear; 6 mm thick minimum.
- C. Primer: Alkyd primer sealer type.
- D. Wood Filler: Solvent base, tinted to match surface finish color.

2.06 WOOD TAPE

- A. 1 1/8" wide wood veneer tape to be applied with contact adhesive.
- B. Available Source: Tape-Ease Distribution; www.tapeease.com

2.07 FABRICATION.

- A. Cap exposed plastic laminate finish edges.
- B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting

2.08 FINISHING

- A. On items to receive transparent finishes, use wood filler which matches surrounding surfaces and of types recommended for applied finishes.
- B. Finish work in accordance with AWI Architectural Woodwork Quality Standards Illustrated, Section 1500, System TR-2 (Transparent).

2.09 SOLID SURFACES

- A. Solid Surfacing Sheet and Plastic Resin Castings: Manufactured cast polymer solid surface material composed of polyester-acrylic resin, UV stabilizer, Aluminum Trihydrate, mineral fillers and colorants to comply with ISSFA-2 and NEMA LD-3; material to be homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coatings; color and pattern consistent throughout thickness.
- B. Surface Burning Characteristics: Flame Spread 25, maximum; Smoke Developed 450, maximum; when tested in accordance with ASTM E84.
- C. Integral castings to be in compliance with ANSI Z124.
- D. Joint Adhesive: Manufacturer's standard two-part adhesive kit to create inconspicuous, non-porous joints, with chemical bond.
- E. Panel Adhesive: Manufacturer's standard panel adhesive.

- F. Sealant: Manufacturer's standard mildew-resistant, FDA/UL recognized silicone sealant in color-matching or clear formulations.
- G. Color: Standard Manufacturers Colors

2.09 COAT HOOKS

- A. Coat hook, Bobrick, Stainless Steel, 22 Gauge, Concealed mounting bracket, Satin Finish
 - 1. Product: Bobrick, B-6827

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

- A. Set and secure materials and components in place, plumb and level.
- B. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (1 mm). Do not use additional overlay trim to conceal larger gaps.
- C. Install wood veneer plywood paneling with full bed contact adhesive applied to substrate and exposed.
- D. Install fabric tape on substrate at all 1/4 inch reveals between wood veneer panels.

3.03 PREPARATION FOR SITE FINISHING

- A. Set fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.
- B. Site Finishing: Refer to Section 09900.

3.04 ERECTION TOLERANCES

- A. Maximum Variation from True Position: 1/16 inch (1.5 mm).
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.7 mm).

END OF SECTION

SECTION 06700

FIBERGLASS REINFORCED PLASTIC PANELS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Fiberglass reinforced polyester panel system for adhesive mounting.
- B. Moldings, adhesive, and joint sealants.

1.02 REFERENCES

- A. ASTM D 256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2002.
- B. ASTM D 570 - Standard Test Method for Water Absorption of Plastics; 1998.
- C. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics; 2002a.
- D. ASTM D 696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer; 1998.
- E. ASTM D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials; 2002.
- F. ASTM D 792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement; 2000.
- G. ASTM D 2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor; 1995 (Reapproved 2001).
- H. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2001.

1.03 SUBMITTALS

- A. See Section 01330 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Selection Samples: For each finish specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- D. Maintenance Instructions.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based

materials, in accordance with requirements of local authorities having jurisdiction.

1.05 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers are limited to the following:
 1. Marlite (330) 343-6621. Fax: (330) 343-7296. www.marlite.com
 2. Nudo Product Inc.; Fiber-Lite Liner Panels (217) 528-5636 www.nudo.com
 3. Crane Composites, Inc. (815) 467-8600 www.cranecomposites.com
 4. Substitution Request required.

2.02 PANEL SYSTEM

- A. Plastic Panel System: Factory finished panels, trim, sealant, and accessories.
- B. FRP Panels; fiberglass reinforced polyeste.
 1. Surface Burning Characteristics: Flame spread index of 200 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E 84 (Class C/III).
 2. Surface Texture: Gently pebbled, high-gloss.
 3. Color: As selected from manufacturer's standard selection.
 4. Thickness: 3/32 inch (2.4 mm), nominal.
 5. Width: 48 inches (1220 mm).
 6. Height: See Drawings (no horizontal joints permitted below 9 feet).
 7. Flexural Strength: 17,000 psi (117 MPa), when tested in accordance with ASTM D 790.
 8. Flexural Modulus: 600,000 psi (4137 MPa), when tested in accordance with ASTM D 790.
 9. Tensile Strength: 8,000 psi (55 MPa), when tested in accordance with ASTM D 638.
 10. Tensile Modulus: 9,430 psi (65 MPa), when tested in accordance with ASTM D 638.
 11. Barcol Hardness: 40, when tested in accordance with ASTM D 2583.
 12. Impact Resistance: 7 ft-lb/in (1225 N/m), when tested in accordance with ASTM D 256, Izod method.
 13. Coefficient of Thermal Expansion: 0.0000157 in/in/degree F (0.0000283 mm/mm/degree C), measured in accordance with ASTM D 696.
 14. Water Absorption: 0.17 percent, when tested in accordance with ASTM D 570.
 15. Specific Gravity: 1.53, when tested in accordance with ASTM D 792.
- C. Panel Trim: Extruded PVC, in manufacturer's standard colors.
 1. Outside corners, inside corners, edge trim, and division molding.
 2. Base Molding: Design that simplifies installation and helps seal wall panel system, with factory made corners and splices.
- D. Sealant: Marlite Silicone Sealant; gunnable silicone rubber; clear.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Owner of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Take panels out of cartons and allow to acclimatize to room conditions for at least 48 hours prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Clean surfaces thoroughly prior to installation.
- D. Protect existing surfaces from damage due to installation.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Use the adhesives recommended by the panel manufacturer unless prohibited by local regulations; obtain manufacturer's approval of alternative adhesives.
- C. Install continuous bead of silicone sealant in each joint and trim groove and between trim and adjacent construction, maintaining 1/8 inch (3 mm) expansion space.
- D. Avoid contamination of panel faces with adhesives, solvents, or cleaners; clean as necessary and replace if not possible to repair to original condition.
- E. Protect installed products until completion of project.
- F. Touch-up, repair or replace damaged products after Substantial Completion.

END OF SECTION

SECTION 07210
BUILDING INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Building Wrap.
 - 2. Foam-plastic board insulation.
 - 3. Glass-fiber blanket insulation.
 - 4. Sill Sealer.
 - 5. Spray polyurethane foam insulation.
 - 6. Vapor retarders.
- B. Related Sections:
 - 1. Division 6 Section "Rough Carpentry".
 - 2. Division 7 Section "Coated Foamed Roofing".
 - 3. Division 7 Section "Sheet Metal Flashing and Trim".

1.03 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Inspections: Contractor is to notify the Owners Representative a minimum of 24 hours in advance of covering the vapor retarder and insulation with GWB or alternate materials to allow inspection.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with

manufacturer's written instructions for handling, storing, and protecting during installation.

- B. Protect foam-plastic board insulation as follows:
1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.01 FOAM-PLASTIC BOARD INSULATION

- A. Molded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. DiversiFoam Products.
 - b. Insulfoam.
 - c. Plymouth Foam, Inc.
 - d. Approved Equal.
 2. Type II, 15 psi.
- B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

2.02 GLASS-FIBER BLANKET INSULATION

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. CertainTeed Corporation.
 2. Guardian Building Products, Inc.
 3. Johns Manville.
 4. Knauf Insulation.

5. Owens Corning.
6. Approved equal.

B. Types: See Drawings for Locations

1. Thermal Batt Insulation – Unfaced: Complies with property requirements of ASTM C 665, Type I and ASTM E 136; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84.
2. Blanket Insulation – Unfaced, 3" (at Interior Partitions): ASTM C 665, Type I and ASTM E 136; with maximum flame-spread and smoke-developed indexes of 10 and 10, respectively, per ASTM E 84. Noise reduction coefficients in accordance with ASTM E 405, Type A.

C. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:

1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
2. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

2.03 VAPOR RETARDERS

- A. Polyethylene Vapor Retarders: ASTM D 4397, 8 mils thick, with maximum permeance rating of 0.13 perm.
- B. Vapor-Retarder Tape: Pressure-sensitive with cold weather adhesive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.
- D. Single-Component Nonsag Urethane Sealant: See Section 07920.
- E. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.
- F. Roof system vapor retarder: See Section 07570.

2.04 POLYURETHANE FOAM

- A. Polyurethane Foam for walls: Rigid, cellular polyurethane; complying with ASTM C 1029, Type I; spray applied, with fire retardants as required, and acceptable to coating manufacturer.

1. -of-Design Product: Subject to compliance with requirements, provide “Bayseal 1.9 CC Polar” by Bay Systems North America or a comparable product by one of the following:
 - a. Polyurethane Foam Enterprises LLC.
 - b. Roofing Systems, Inc.; an ITW company.
 - c. Western LLC.
 - d. Polymers, Inc.
 - e. Coatings Corporation.
 - f. Specialty Products, Inc.
 - g. Approved Equal.
2. In-Place Density: 1.9 lb/cu. ft.; ASTM D 1622.
3. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 75 or less.
4. Thickness: Fill wall cavities as indicated.
5. R-value: The “R” value for spray foam insulation will be calculated using an R-value of R6 per inch thickness.

2.05 AUXILIARY INSULATING MATERIALS

- A. Low-Expanding Foam Sealant for insulation gaps around doors and windows: “Enerfoam” by Dow Chemical, Inc.; or approved equal.

2.06 AIR INFILTRATION BARRIER

- A. Air Infiltration Barrier: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. DuPont (E. I. du Pont de Nemours and Company); Tyvek CommercialWrap
 - b. Ludlow Coated Products; Barricade Building Wrap
 - c. Pactiv, Inc.; GreenGuard.
 - d. Raven Industries Inc.; Fortress Pro Commercial Wrap.
 - e. Reemay, Inc.; Typar Storm Wrap.
 - f. Approved Equal.

2. Water-Vapor Permeance: Not less than 150 g through 1 sq. m of surface in 24 hours per ASTM E 96/E 96M, Desiccant Method (Procedure A).
 3. Air Permeance: Not more than 0.004 cfm/sq. ft. at 0.3-inch wg when tested according to ASTM E 2178.
 4. Allowable UV Exposure Time: Not less than three months.
- B. Building-Wrap Tape: Provide pressure-sensitive plastic tape, code approved sheathing tape with cold weather adhesive recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap, minimum 2 inches wide.
- C. Adhesive: As recommended by membrane manufacturer for substrate and environmental conditions.
- D. Sealant: ASTM C920; Cold weather, elastomeric polyurethane or butyl sealant, building code approved; do not use silicone-based sealant.

2.07 SILL SEALERS

- A. Sill-Sealer Gaskets: Compressible, cold weather, closed-cell; EPDM, neoprene, or polyethylene foam, 1/2 inch thick. Product service temperature: -60°F to +90°F. Provide product selected from manufacturer's standard widths to suit width of sill members or joints indicated.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, vapor retarders, or air infiltration barriers, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.

3.02 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time..
- C. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.03 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
 - 5. For wood-framed construction, install blankets according to ASTM C 1320.
- C. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.
- D. Low expansion foam insulation around roof, wall, and floor penetrations: At locations around doors, windows, cavities and similar locations with voids under several inches in width, fill joint opening with low expansion foam. Apply in multiple layers to prevent distortion of opening or frame. Begin application with the first layer applied to the exterior or cold side of the joint. Allow each application to cure independently before application of subsequent layers of low expansion foam. Trim interior surface slightly below interior surface to allow installation of backer rod and sealant.
- E. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Loose-Fill Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.
 - 2. Spray Polyurethane Insulation: Apply spray polyurethane foam according to manufacturer's written instructions.

3.04 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

- A. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches up either side of partitions.

3.05 INSTALLATION OF VAPOR RETARDERS

- A. Place vapor retarders on warm side of construction as indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Vapor Retarder is to function as an interior air barrier and as a vapor retarder to prevent all movement of heated interior air through the framing construction towards the exterior. All joints, laps, penetrations, holes gaps, etc. are to be sealed airtight prior to covering with wall, floor or roof finishes or assemblies.
- C. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.
 - 1. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches o.c.
 - 2. Before installing vapor retarders, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
 - 3. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.
- D. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.
- E. Doors, Windows, and openings through exterior walls: On interior, after installation of low expansion foam insulation, install backer rod if required in joint between frame of window and flashed rough opening. Apply sealant around entire window to create air seal and vapor retarder. Apply sealant in accordance with sealant manufacturer's instructions and ASTM C1193. As an alternate, the vapor retarder may be sealed directly to the window or door frame at non-visible location on the warm side of the insulation.
- F. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.06 BUILDING WRAP INSTALLATION

- A. Cover exposed exterior surface of sheathing with building wrap securely fastened to framing immediately after sheathing is installed.
- B. Cover sheathing with building wrap as follows:
 - 1. Cut back building wrap 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
 - 2. Apply wrap to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.
 - 3. Start wrap installation at a building corner, leaving 6-12 inches of barrier extended beyond corner to overlap.
 - 4. Install wrap in a horizontal manner starting at the lower portion of the wall surface. Maintain wrap plumb and level.
 - 5. Subsequent layers shall overlap lower layers a minimum of 6 inches horizontally in a shingling manner.
 - 6. Extend bottom roll edge over sill plate interface 2" to 3" minimum. Ensure weeps are not blocked.
 - 7. Seal terminations of extent of wrap with sealant and seal laps with tape.
 - 8. Seal seams of wrap with seam tape at all vertical and horizontal overlapping seams. Seal tears or cuts with tape.
 - 9. Window and door openings: Extend wrap completely over openings.
- C. Opening Preparation: (for use with flanged windows)
 - 1. Cut wrap membrane in a modified "I-cut" pattern.
 - 2. Cut wrap horizontally along the bottom of the header.
 - 3. Cut wrap vertically 2/3 of the way down from top center of window opening.
 - 4. Cut wrap diagonally from bottom of center vertical cut to the left and right corners of the opening.
 - 5. Fold side and bottom wrap flaps into window opening and fasten.
 - 6. Cut a head flap at 45-degree angle in the weather barrier membrane at window head to expose 8 inches of sheathing. Temporarily secure wrap flap away from sheathing with tape.

3.07 FLEXIBLE FLASHING INSTALLATION

- A. Apply flexible flashing around all protrusions and openings through the walls and at all heads, sills, and jambs of all openings and as indicated to comply with or exceed manufacturer's written instructions.
 - 1. Prime substrates as recommended by flashing manufacturer.
 - 2. Begin installation at sill and continue installation in shingle fashion upward. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
 - 3. Lap flashing over water-resistive barrier at bottom and sides of openings.
 - 4. Lap building wrap over flashing at heads of openings.

5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.
6. On exterior, apply continuous bead of sealant to wall or backside of window mounting flange across jambs and head. Do not apply sealant across sill.
7. Install window according to manufacturer's instructions.
8. Apply 4-inch wide strips of flashing at jambs overlapping entire mounting flange. Extend jamb flashing 2-inches above top of rough opening and below bottom edge of sill flashing.
9. Apply 4-inch wide strip of flashing as head flashing overlapping the mounting flange. Head flashing should extend beyond outside edges of both jamb flashings.
10. Position building wrap head flap across head flashing. Adhere using 4-inch wide flashing over the 45-degree seams.
11. Tape head flap in accordance with manufacturer recommendations.

3.08 PROTECTION

- A. Protect installed insulation, vapor retarders, and building wrap air infiltration barriers from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 07412

METAL WALL PANELS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Exposed-fastener, lap-seam metal wall panels.
- B. Related Sections:
 - 1. Division 6 Section "Rough Carpentry".
 - 2. Division 7 Section "Joint Sealants"
 - 3. Division 7 Section "Sheet Metal Flashing and Trim".

1.03 DEFINITION

- A. Metal Wall Panel Assembly: Metal wall panels, attachment system components, miscellaneous metal framing and accessories necessary for a complete weathertight wall system.

1.04 PERFORMANCE REQUIREMENTS

- A. General Performance: Metal wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E 283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 1.57 lbf/sq. ft.
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- D. Water Penetration under Dynamic Pressure: No evidence of water leakage when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. and not more than 12 lbf/sq. ft..
 - 1. Water Leakage: Uncontrolled water infiltrating the system or appearing on system's normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.

- E. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:
 - 1. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - a. Uniform pressure of 30 lbf/sq. ft. acting inward or outward.
 - b. Uniform pressure as indicated on Drawings.
 - 2. Deflection Limits: Metal wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/240 of the span.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.05 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of wall panel and accessory.
- B. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory-, shop- and field-assembled work.
 - 1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
 - a. Flashing and trim.
 - b. Anchorage systems.
- C. Samples for Initial Selection: For each type of metal wall panel indicated with factory-applied color finishes.
 - 1. Include similar Samples of trim and accessories involving color selection.
 - 2. Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Metal Wall Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal wall panel accessories.
 - 2. Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
 - 3. Accessories: 12-inch- long Samples for each type of accessory.

- E. Coordination Drawings: Exterior elevations drawn to scale and coordinating penetrations and wall-mounted items. Show the following:
 - 1. Wall panels and attachments.
 - 2. Girts and Stud framing.
 - 3. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
 - 4. Penetrations of wall by pipes and utilities.
- F. Qualification Data: For Installer.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- H. Field quality-control reports.
- I. Maintenance Data: For metal wall panels to include in maintenance manuals.
- J. Warranties: Sample of special warranties.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain each type of metal wall panel from single source from single manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.
- B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal wall panel for period of metal wall panel installation.

1.08 PROJECT CONDITIONS

- A. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication, and indicate measurements on Shop Drawings.

1.09 COORDINATION

- A. Coordinate metal wall panel assemblies with rain drainage work, flashing, trim, and construction of girts, studs, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS

- A. General: Provide factory-formed metal wall panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.
- B. Nu-Wave Profile, Exposed-Fastener Metal Wall Panels: Formed with 7/8" deep corrugations, evenly spaced across panel width.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide "Nu-Wave by AEP-Span" or a comparable product by one of the following:
 - a. Alcoa Architectural Products (USA).
 - b. Fabral.
 - c. Firestone Building Products.
 - d. Industrial Building Panels.
 - e. MBCI; Div. of NCI Building Systems.
 - f. Metal Sales Manufacturing Corporation.
 - g. Approved Equal.
 - 2. Material: Aluminum-zinc alloy-coated steel sheet, 22 gauge nominal thickness.
 - a. Exterior Finish: 2-coat fluoropolymer.
 - b. Color: As selected by Architect from manufacturer's full range.
 - 3. Rib Spacing: 7.2 inches o.c.

4. Panel Coverage: 36 inches.
 5. Panel Height: 1.5 inches. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 6. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M; structural quality.
 7. Exposed Coil-Coated Finish:
 - a. 2-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 8. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.
- C. Panel Sealants:
1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
 2. Joint Sealant: ASTM C 920; elastomeric polyurethane sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.

2.02 MISCELLANEOUS METAL FRAMING

- A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G60 hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.
- B. Zee Clips: 0.079-inch nominal thickness.
- C. Base or Sill Angles or Channels: 0.079-inch nominal thickness.
- D. Hat-Shaped, Rigid Furring Channels:
 1. Nominal Thickness: 0.040 inch.
 2. Depth: 1-1/2 inches.
- E. Cold-Rolled Furring Channels: Minimum 1/2-inch-wide flange.
 1. Nominal Thickness: 0.064 inch.
 2. Depth: 3/4 inch.
 3. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with 0.040-inch nominal thickness.
- F. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, and depth required to fit insulation thickness indicated.
 1. Nominal Thickness: 0.025 inch.

- G. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

2.03 MISCELLANEOUS MATERIALS

- A. Panel Fasteners: Stainless steel screws, bolts, nuts, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of factory-applied coating. Provide EPDM sealing washers.

2.04 ACCESSORIES

- A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.
 - 1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
 - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 - 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- B. Flashing and Trim: Formed from 24 gauge minimum thickness, aluminum-zinc alloy-coated steel sheet prepainted with coil coating. See also Section 07620.

2.05 FABRICATION

- A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, and that will minimize noise from movements within panel assembly.
- E. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
3. Conceal fasteners and expansion provisions where possible.
4. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.06 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.
 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
 3. Verify that weather-resistant sheathing paper has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
 4. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

- B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorages according to ASTM C 754 and metal wall panel manufacturer's written recommendations.
- B. Soffit Framing: Wire-tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

3.03 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal wall panels.
 - 2. Flash and seal metal wall panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Install flashing and trim as metal wall panel work proceeds.
 - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - 7. Apply elastomeric sealant continuously between metal base channel (sill angle) and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
 - 8. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 - 9. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal wall panel manufacturer.
- C. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.

1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints of all wall panels.
 2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."
- D. Lap-Seam Metal Wall Panels: Fasten metal wall panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
1. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
 2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal wall panels.
 3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
 5. Provide sealant tape at lapped joints of metal wall panels and between panels and protruding equipment, vents, and accessories.
 6. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps; on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weathertight.
 7. At panel splices, nest panels with minimum 6-inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.

3.04 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges

folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.

2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.05 FIELD QUALITY CONTROL

- A. Testing Agency: Owner may engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Water Penetration: Test areas of installed system indicated on Drawings for compliance with system performance requirements according to ASTM E 1105 at minimum differential pressure of 20 percent of inward-acting, wind-load design pressure as defined by SEI/ASCE 7, but not less than 6.24 lbf/sq. ft.
- C. Water-Spray Test: After completing the installation of 75-foot- by-2-story minimum area of metal wall panel assembly, test assembly for water penetration according to AAMA 501.2 in a 2-bay area directed by Architect.
- D. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
- E. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.06 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.
- B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07570
COATED FOAMED ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Spray-applied, coated, polyurethane foam roofing.
- B. Related Requirements:
 - 1. Section 06100 "Rough Carpentry".
 - 2. Section 06100 "Finish Carpentry".
 - 3. Section 07620 "Sheet Metal Flashing and Trim".
 - 4. Section 07920 "Joint Sealants".

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at a location selected by the Owner.
 - 1. Review methods and procedures related to coated foamed roofing including, but not limited to, the following:
 - a. Load limitations on in-place roofing.
 - b. Construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - c. Surface preparation specified in other Sections.
 - d. Minimum curing period.
 - e. Contractors plan for roof application in inclement weather.
 - f. Forecasted weather conditions.
 - g. Special details and sheet flashings.
 - h. Repairs.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties.
- B. Samples for Initial Selection: For each type of exposed product, finish, and color.
 - 1. Include Samples of auxiliary materials and accessories involving color and finish selection.
- C. Samples for Verification: For coated foamed roofing, prepared on Samples of size indicated below:
 - 1. Samples, 24 by 24 inches, on rigid backing, showing polyurethane foam of thickness required and stepped coatings in colors required to illustrate buildup of coated foamed roofing.
 - 2. Include Samples of auxiliary materials and accessories to verify color and finish selected.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and applicators.
- B. Product Certificates: For each type of coated foam roofing.
- C. Evaluation Reports: For coated foamed roofing, from ICC-ES.
- D. Field quality-control reports.
- E. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For coated foamed roofing to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who is approved, authorized, or licensed by coating manufacturer for installation of manufacturer's product over polyurethane foam.
- B. Comply with recommendations in SPFA AY-104, "Spray Polyurethane Foam Systems for New and Remedial Roofing."

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site with manufacturer's name, product brand name and type, date of manufacture, shelf life, and directions for storing and mixing with other components.
- B. Store materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by manufacturer.
- C. Remove and replace material that cannot be applied within its stated shelf life.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace coated foamed roofing that does not comply with requirements or that does not remain watertight within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Material Compatibility: Provide polyurethane foam, coatings, substrate board, and auxiliary materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Source Limitations for Coated Foamed Roofing System: Obtain coating from single source from single manufacturer and polyurethane foam from single manufacturer acceptable in writing to coating manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Coated foamed roofing shall withstand exposure to weather without failure due to defective manufacture, installation, or other defects in construction. Membrane roofing shall remain watertight.
- B. Fire-Test-Response Characteristics: Provide coated foamed roofing with the fire-test-response characteristics indicated, as determined by testing identical systems according to test methods below for deck type and slopes indicated by a qualified testing and inspecting agency that is acceptable to authorities having jurisdiction.
 - 1. Class C roof covering according to ASTM E 108 or UL 790.
 - 2. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

- a. Flame-Spread Index: 75 or less.
3. Fire-Resistance Ratings: Comply with ASTM E 119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- C. Roofing-System Design: Provide a coated foamed roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
 1. Corner Uplift Pressure: -44 lbf/sq. ft.
 2. Perimeter Uplift Pressure: -43 lbf/sq.ft..
 3. Field-of-Roof Uplift Pressure: -29 lbf/sq.ft.

2.3 POLYUREA VAPOR RETARDER

- A. Polyurea sprayed vapor retarder: To be the same product as the sprayed polyurethane foam coating, applied as a thinner coating layer over the substrate prior to foam application and acceptable to the foam and coating manufacturer.
 1. -of-Design Product: Subject to compliance with requirements, provide "Polyshield Hi-E" by Specialty Products or a comparable product by one of the following:
 - a. Roofing Systems, Inc.; an ITW company.
 - b. North America; a subsidiary of Bayer Material Science AG.
 - c. Western LLC.
 - d. ; Div. of Jones-Blair Company.
 - e. Coatings; a subsidiary of Quest Specialty Chemicals.
 - f. Approved Equal.
 2. Color: Off white or tan.
 3. Tensile Strength: 2500 psi minimum according to ASTM D 412.
 4. Elongation: >700% @ 77° F
 5. Service Temperature: -60 to 300° F.
 6. Tear Resistance: lbf/inch minimum according to ASTM D 624.
 7. Thickness: 10 mils, dry.

2.4 POLYURETHANE FOAM

- A. Polyurethane Foam: Rigid, cellular polyurethane; complying with ASTM C 1029, Type II; spray applied, with fire retardants as required, and acceptable to coating manufacturer.

1. -of-Design Product: Subject to compliance with requirements, provide “Bayseal 3.0” by Bay Systems North America or a comparable product by one of the following:
 - a. Polyurethane Foam Enterprises LLC.
 - b. Roofing Systems, Inc.; an ITW company.
 - c. Western LLC.
 - d. Polymers, Inc.
 - e. Coatings Corporation.
 - f. Specialty Products, Inc.
 - g. Approved Equal.
2. In-Place Density: Roof and sloped walls: 3.0 lb/cu. ft.; ASTM D 1622.
 - a. Floor and end walls: 1.9 lb/cu. ft.; ASTM D 1622.
3. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 75 or less.
4. Thickness: 9.0-inches or as indicated.
5. R-value: The “R” value for spray foam insulation will be calculated using an R-value of R6 per inch thickness.

2.5 POLYUREA COATINGS

- A. Polyurea Base Coat: Spray applied, plural component, polyurea elastomer coating specifically formulated for coating sprayed polyurethane-foam roofing.
 1. -of-Design Product: Subject to compliance with requirements, provide “Polyshield Hi-E” by Specialty Products or a comparable product by one of the following:
 - a. Roofing Systems, Inc.; an ITW company.
 - b. North America; a subsidiary of Bayer Material Science AG.
 - c. Western LLC.
 - d. ; Div. of Jones-Blair Company.
 - e. Coatings; a subsidiary of Quest Specialty Chemicals.
 - f. Approved Equal.
 2. Base Coat: Plural-component Polyurea, color contrasting with topcoat.
 - a. Color: To be selected by Architect from Manufacturer’s full range of colors.
 - b. Thickness on roof, walls, floor: 32 mils, dry.

3. Tensile Strength: 2500 psi minimum according to ASTM D 412.
4. Elongation: >700% @ 77° F
5. Service Temperature: -60 to 300° F.
6. Tear Resistance: lbf/inch minimum according to ASTM D 624.
7. Application: To all exposed spray applied polyurethane foam surfaces.

2.6 SILICONE COATINGS

- A. Silicone Coating: Liquid silicone elastomeric coating system specifically formulated for coating sprayed polyurethane-foam roofing.
 1. -of-Design Product: Subject to compliance with requirements, provide “Durasil” by Specialty Products, Inc. or comparable product by one of the following:
 - a. Polyurethane Foam Enterprises LLC.
 - b. North America; a subsidiary of Bayer Material Science AG.
 - c. Roofing Systems, Inc.; an ITW company.
 - d. Western LLC.
 - e. Coatings; a subsidiary of Quest Specialty Chemicals.
 - f. Approved Equal.
 2. Composition: One-component silicone.
 3. Topcoat Color: To be selected by Architect from Manufacturer’s full range of colors.
 4. Tensile Strength: 420 minimum according to ASTM D 412.
 5. Elongation: Equal to or greater than 190% @ 77° F
 6. Service Temperature: -80 to 300° F.
 7. Permeance: Minimum 2 perms at 55 mils thick according to ASTM E 96/E 96M.
 8. Thickness: 24 Mils, dry.
 9. Application: To all roof and sloped surfaces, not floors.

2.7 SUBSTRATE BOARD

- A. Substrate board/Thermal Barrier: Plywood sheathing, Exterior, Exposure 1, grade CDX, 1/2-inch thick.
- B. Thermal-Barrier Fasteners: Factory-coated steel fasteners and metal plates complying with corrosion-resistance provisions in FM Approvals 4470, and designed and sized for fastening thermal barrier to substrate.

2.8 AUXILIARY MATERIALS

- A. Primer: Polyurethane foam manufacturer's standard factory-formulated primer.

- B. Vapor Retarder: Polyurea, same as base coat for foam roofing; applied at 10-mils thick (dry).
- C. Sealant: ASTM C 920, Class 25, Use NT, Grade NS, as recommended by coated foamed roofing manufacturer for substrate and joint conditions and for compatibility with roofing materials.
- D. Intumescent Coating: "FlameSeal-TB" by Specialty Products, Inc. or approved equal. Application thickness to be 25 wet mils thick over polyurea coated spray foam insulation under the floor assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that related work is complete. Do not install coated foamed roofing until roof openings, curbs, and parapets, if any, are complete and roof drains, vents, and other roof penetrations are in place.
- B. Examine substrates, areas, and conditions under which coated foamed roofing will be applied, with Installer present, for compliance with requirements.
- C. Proceed with installation only after unsatisfactory conditions have been corrected and substrates are dry.
- D. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing work to be performed according to manufacturer's written instructions and warranty requirements.
 - 1. Apply materials within the range of ambient and substrate temperatures recommended by material manufacturers, but not below 50 deg F.
 - 2. Apply materials within range of relative humidity recommended by manufacturer of each component, but not when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F above dew point.
 - 3. Do not apply materials to damp or wet surfaces.
 - 4. Do not apply primers, polyurethane foam, or coatings in snow, rain, fog, or mist, or when such weather conditions are imminent during the application and curing period.
 - 5. Do not apply polyurethane foam when wind conditions result in surface finish textures not complying with requirements.
 - 6. Do not apply coatings when wind conditions prevent uniform coating application.

3.2 SUBSTRATE BOARD

- A. General: Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
- B. Securement: Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to coated foamed roofing manufacturer's written instructions.

3.3 SURFACE PREPARATION

- A. General: Clean and prepare substrate according to coated foamed roofing manufacturer's written instructions. Provide clean, dust-free, dew-free, and dry substrate for coated foamed roofing application.
- B. Remove grease, oil, form-release agents, curing compounds, and other contaminants from substrate.
- C. Cover and mask adjoining surfaces not receiving coated foamed roofing to prevent overspray or spillage affecting other construction. Temporarily close off roof drains, removing roof-drain plugs when not doing coated foamed roofing work or when rain is forecast.
 - 1. Remove masking after polyurethane foam application; cover and re-mask adjoining surfaces before coating polyurethane foam.
- D. Prime substrate as recommended by coated foamed roofing manufacturer.

3.4 POLYUREA VAPOR RETARDER APPLICATION

- A. General: Mix and apply Polyurea vapor retarder according to manufacturer's written instructions.
- B. Fill, cover, or tape joints and cracks in substrate that exceed a width of 1/16-inch. Remove dust and dirt from narrower joints and cracks before applying Polyurea vapor retarder.
- C. Install vapor retarder according to coated foamed roofing manufacturer's written instructions.

3.5 POLYURETHANE FOAM APPLICATION

- A. General: Mix and apply polyurethane foam according to ASTM D 5469 and coated foamed roofing manufacturer's written instructions.
 - 1. Fill irregularities and depressions to prevent ponding water.

2. Apply the required full thickness of polyurethane foam in any specific area on same day.
 3. Apply only the area of polyurethane foam that can be covered with required base coating on same day or within 24 hours.
 4. Apply polyurethane foam to avoid overspray beyond immediate area of work.
- B. Apply polyurethane foam in lift thicknesses not less than 1/2 inch and not more than 2 inches.
- C. Uniformly apply total thickness of polyurethane foam indicated, but not less than 1 inch, to a surface tolerance of plus 1/4 inch and no minus.
1. Slope to Drain: Vary thickness uniformly and fill low spots to achieve minimum 1/4 inch per foot slope to drain unless otherwise indicated.
- D. Apply polyurethane foam to roof penetrations, terminations, and vertical surfaces as indicated. Unless otherwise indicated, extend polyurethane foam at least 4 inches above elevation of adjacent roof field.
- E. Surface Finish: Provide finished surface of polyurethane foam within the following range of surface textures as defined by ASTM D 5469:
1. Texture: Smooth to orange peel.
- F. Remove and replace polyurethane foam not complying with surface-texture limitations. Remove defective thickness and prepare and reapply polyurethane foam with acceptable, uniform results.

3.6 COATING APPLICATION

- A. Allow polyurethane foam substrate to cure for a minimum of two hours before coating, and apply coating system to polyurethane foam no later than 24 hours after the application of the foam. Remove dust, dirt, water, and other contaminants before applying coating system.
- B. Apply coating system to polyurethane foam by spray, roller, or other suitable application method according to coating manufacturer's written instructions.
- C. Apply base coat and one or more topcoats to obtain a uniform, seamless membrane free of blisters and pinholes. Apply each coat at right angles to preceding coat, using contrasting color tints for successive coats.
1. Apply topcoat(s) after removing dust, dirt, water, and other contaminants from base coat.
 2. Urethane Coating: Apply coating system to a minimum dry film thickness of 32 mils.

3. Silicone Coating: Apply coating system to a minimum dry film thickness of 24 mils.
- D. Height at Terminations: Apply coating system at wall terminations and other vertical surfaces to extend vertically beyond polyurethane foam by a minimum of 4 inches or as indicated.
- E. Sealant: Apply sealant to perimeter and other terminations where indicated on Drawings or required by coated foamed roofing manufacturer.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
 1. Testing agency will identify, seal, and certify samples of materials taken from Project site, with Contractor present.
 2. Testing agency will perform tests for product characteristics specified or cited in manufacturer's product data.
 - a. Two core samples will be required for roof areas up to 5,000 sq. ft., and one core sample will be required for each additional 5,000 sq. ft. or part thereof.
 - b. Six slit-test samples will be required for each 5,000 sq. ft. of roof area to determine, as a minimum, the number of coats applied and dry film thickness of coating.
 3. Testing agency will verify that surfaces slope to drain.
- B. Coated foamed roofing will be considered defective if it does not pass tests and inspections.
- C. Refill cores, repair slits, and re-coat test areas.
- D. Prepare test and inspection reports.

3.8 REPAIR AND RE-COATING

- A. Correct deficiencies in, or remove, foam or coatings that do not comply with requirements; fill and repair substrates and reapply materials.
- B. Repair and re-coat coated foamed roofing according to ASTM D 6705 and manufacturer's written instructions.

3.9 CURING, PROTECTING, AND CLEANING

- A. Cure coatings according to manufacturer's written instructions, taking care to prevent contamination and damage during application stages and curing. Do not permit traffic on uncured coatings.
- B. Protect coated foamed roofing from damage and wear during remainder of construction period.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07570

SECTION 07620

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Formed steep slope roof sheet metal fabrications.
 - 2. Miscellaneous metal roof and wall flashings.
- B. RELATED WORK Related Sections include the following:
 - 1. Division 6 Section "Rough Carpentry".
 - 2. Division 7 Section "Joint Sealants".
 - 3. Division 7 "Coated Foam Roofing".

1.03 REFERENCES

- A. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M

1.04 SYSTEM DESCRIPTION

- A. Work of this Section is to physically protect base flashings, parapets, and penetrations from damage that would permit water leakage to building interior, or into roof insulation.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
- B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.
- C. Applicator: Company specializing in sheet metal flashing work with three years minimum experience. Provide documentation stating the above.
- D. Prefinished Metal Supplier: Company specializing in coil coating and fabrication of commercial flashings with five years minimum experience. Provide documentation stating the above.

1.06 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather

without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

- B. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.07 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Submit sample of the finish warranty and submit the final warranty signed by the manufacturer.
- C. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
 - 1. Identification of material, thickness, weight, and finish for each item and location in Project.
 - 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 - 3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 - 4. Details of termination points and assemblies, including fixed points.
 - 5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
 - 6. Details of edge conditions, including eaves, ridges, rakes, crickets, and counterflashings as applicable.
 - 7. Details of special conditions.
 - 8. Details of connections to adjoining work.
- D. Samples for initial selection: Provide two each per color 2-inch x 2-inch minimum sized sample of prefinished metal illustrating typical material, and finish, for color selection by ARCHITECT.
- E. Qualification Data: For qualified fabricator.
- F. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.
- G. Warranty: Sample of special warranty.

1.08 STORAGE AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.09 WARRANTY

- A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
- B. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SHEET MATERIALS

- A. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - 1. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, structural quality.
 - 2. Surface: Smooth, flat.
 - 3. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 4. Color: Color selection to be by ARCHITECT from the manufacturer's full range.
 - 5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.
 - 6. Manufacturers:
 - a. AEP Span.

- b. ColorKlad by Ryerson.
 - c. Firestone, Inc.
 - d. Metal Sales.
 - e. Approved equal.
- B. For specific sheetmetal thickness use the gauge indicated. See also the schedule at the end of this section.

2.02 UNDERLAYMENT MATERIALS

- A. See Section 07570.

2.03 SELF ADHERED MEMBRANE

- A. Self Adhered membrane: Grace Ice and Water Shield,
- 1. Thickness: 40 mil
 - 2. Tensile Strength: 250 psi
 - 3. Permeance: 0.05 perms Max
 - 4. Low Temperature flexibility: -20 degrees F

2.04 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
- 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using factory-applied coating, with soft EPDM gaskets.
 - b. Blind Fasteners: High-strength stainless steel rivets suitable for metal being fastened.
 - 2. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 - 3. Fasteners for Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel.
- C. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight. See Section 07920.

2.05 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to

design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 2. Obtain field measurements for accurate fit before shop fabrication.
 3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.
- D. Fabricate hold down cleats and starter strips of galvanized steel sheet, minimum 2 inches wide, interlockable with sheet. Fabricate cleats and starter strips from a metal one gauge heavier than the product being anchored.
- E. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- F. Seams for pre-finished metal: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
- G. Do not use graphite pencils to mark galvanized metal surfaces.
- H. Form pieces in longest practical lengths.
- I. Hem exposed edges on underside minimum 1/2-inch; miter and seam corners.
- J. Fabricate vertical faces with bottom edge formed outward 3/4-inch and hemmed to form drip.

2.06 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials:
1. Aluminum-Zinc Alloy-Coated Steel: 24 gauge thick.
- B. Valley Flashing: Fabricate from the following materials:
1. Aluminum-Zinc Alloy-Coated Steel: 24 gauge thick.
- C. Drip Edges, Eave, Rake, Ridge, and Hip Flashing: Fabricate from the following materials:
1. Aluminum-Zinc Alloy-Coated Steel: 24 gauge thick.

- D. Counterflashing, Flashing Receivers: Fabricate from the following materials:
 - 1. Aluminum-Zinc Alloy-Coated Steel: 24 gauge thick.
- E. Roof-Penetration Flashing: Fabricate from the following materials:
 - 1. Aluminum-Zinc Alloy-Coated Steel: 24 gauge thick.

2.07 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12-foot-long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings. Form with 2-inch-high, end dams where flashing is discontinuous. Fabricate from the following materials:
 - 1. Aluminum-Zinc Alloy-Coated Steel: 24 gauge thick.
- B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from the following materials:
 - 1. Aluminum-Zinc Alloy-Coated Steel: 24 gauge thick.
 - 2. Door Sills; Stainless Steel: 18 gauge thick or as indicated.
- C. Wall Expansion-Joint Cover: Fabricate from the following materials:
 - 1. Aluminum-Zinc Alloy-Coated Steel: 24 gauge thick.

2.08 MISCELLANEOUS SHEET METAL ACCESSORIES

- A. Equipment Support Flashing: Fabricate from the following materials:
 - 1. Aluminum-Zinc Alloy-Coated Steel: 20 gauge thick.
- B. Roof Curb Support
 - 1. Cedar Bevel Siding: Red Cedar, 6" Nominal

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

- A. Verify conditions and critical dimensions affecting fabrication and installation of work of this Section.
- B. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, and cant strips in place, and nailing strips located.
- C. Verify membrane termination and base flashings are in place, sealed, and secure.
- D. Verify that self-adhering membrane has been installed over the top of all curbs and parapets.
- E. Beginning of installation means acceptance of existing conditions.

3.02 UNDERLAYMENT INSTALLATION

- A. General: Install underlayment as indicated on Drawings.

- B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

3.03 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
- B. Install sheet metal flashing and trim to comply with performance requirements and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - 1. Conform to approved shop drawing details.
 - 2. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder and sealant.
 - 3. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 4. Space cleats not more than 12 inches apart. Anchor each cleat with a minimum of two fasteners.
 - 5. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
 - 6. Install sealant tape where indicated.
 - 7. Torch cutting of sheet metal flashing and trim is not permitted.
 - 8. Do not use graphite pencils to mark bare metal surfaces.
- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
 - 1. Underlayment: Where installing stainless-steel sheet metal flashing and trim where flashing and trim will contact wood, or ferrous metal substrates, install a course of self-adhering underlayment.
- D. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

- E. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
- F. Seal joints as shown and as required for watertight construction.
 - 1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
 - 2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed Work.
 - 1. Do not solder metallic-coated steel sheet.
 - 2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.04 ROOF FLASHING INSTALLATION

- A. All flashings shall be sloped to drain positively, minimum 1/4-inch per foot.
- B. At sloped flashing, install pieces overlapping in a downward direction.
- C. Install hold down cleats before starting installation.
- D. Secure flashings in place using concealed fasteners. Use exposed fasteners only in locations shown. The use of fasteners which penetrate low-sloped horizontal surfaces of metal flashings will not be accepted.
- E. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles and installation weathertight.
- F. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant, and secure 24-inches on center or as indicated.
- G. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten. Install a bead of elastomeric sealant around the pipe or post at the top edge of the umbrella.
- H. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.05 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.06 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment.
- B. At flashing assemblies supporting fans, hoods, flues and similar items on top of curbs and parapets, fabricate flashing assembly to maintain positive drainage and support superimposed loads.

3.07 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.08 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean off excess sealants.
- C. Clean and neutralize flux materials. Clean off excess solder.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturers written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.
- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07840

FIRESTOPPING

PART 1 - GENERAL

1.01 CONTRACT CONDITIONS

A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

1.02 EXTENT OF WORK

A. Seal Openings through all Assemblies (both fire rated and not fire rated) as required to prevent the passage or spread of Flame, Smoke, and Hot Gases, including but not limited to the following:

1. Mechanical Piping and Electrical Conduit passing through Walls, Floors, Soffits and Ceilings.
2. Open Joints located between adjacent Fire-rated Walls, Floors, and Ceilings.

1.03 RELATED WORK SPECIFIED IN OTHER SECTIONS

06100 Rough Carpentry
07920 Joint Sealants

1.04 REGULATORY AGENCY REQUIREMENTS

A. Firestopping shall comply with governing Building Code requirements, including successfully passing Hose Stream Tests.

1.05 COORDINATION

A. Coordinate with other Trades affecting or affected by Work of this Section.

1.06 CERTIFICATE OF COMPLIANCE

A. Upon Work completion, submit Manufacturer's written certification that Firestopping has been installed in accordance with these Specifications and in compliance with Regulatory Agency Requirements.

1.07 FIELD MOCK UP

- A. Provide typical examples of each type of Firestopping for Architect's review.
- B. Reprepare, if necessary, until Mock Ups are accepted.
- C. Accepted Mock Ups represent minimum standard of acceptability, and Work of lesser quality is subject to rejection.
- D. Approved Mock Ups may be used on Project Work.

1.08 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver Products to Jobsite in original unopened Containers. Save Containers for Architect's inspection.
- B. Protect Products against damage.
- C. Do not exceed Product "shelf life".
- D. Immediately remove from Project Site any damaged or out-of-date Products.

1.09 ENVIRONMENTAL REQUIREMENTS

- A. Perform no Work when Work Conditions exceed Firestopping Manufacturers' specified limits.

1.10 ADVANCE NOTICES

- B. Notify Architect at least 48 hours prior to covering-over Work of this Section, so that Inspections can be made.

PART 2 - PRODUCTS

2.01 FIRESTOPPING

- A. Manufacturer: Dow, GE, 3M, RectorSeal, STI, USG, or approved.
- B. Material: Shall contain no Asbestos, Halogens, Lead, or Volatile Solvents.
- C. Type: Caulk, Wrap, Strip, Sheet, Mortar, Collars, Foams, Pillows, Pads, Board, or Putty as required by conditions of use.
- D. Fire-Resistiveness: Rated for use as Through-Penetration Firestopping in accordance with ASTM E-814 or UL 1479
- E. Performance Requirements: Firestopping shall be flexible, moisture-resistant, and it shall not shrink or pull away from contact surfaces.
- F. Paintability: Firestopping, if and where exposed to view, shall be paintable or capable of receiving Finish Materials where so specified in other Sections.

PART 3 - EXECUTION

3.01 EXISTING CONDITIONS

- A. Verify that Surfaces to receive Firestopping are clean, dry, and free from Dust, Oil, Grease, Rust, Lacquer, loose Mortar, Ice, Frost, or other Bond-reducing Matter.
- B. Allow Concrete Surfaces to cure at least 4 weeks before applying Sealant.
- C. Prior to starting Work, notify General Contractor about defects requiring correction.
- D. Do not start Work until conditions are satisfactory.

3.02 PROTECTING WORK OF OTHER SECTIONS

- A. Protect against damage and discoloration caused by Work of this Section.
- B. Do not contaminate adjacent Materials.
- C. Mask Surfaces adjacent to Firestopping as required for protection.

3.03 SURFACE PREPARATION

- A. Remove Dust, Dirt, Wax, Moisture, Ice, Frost, and any other Foreign Matter from Surfaces to receive Firestopping.
- B. If and where necessary, provide Backing Support to receive Firestopping.

3.04 PRIMING

- A. If and where so recommended by Firestopping Manufacturer, prime Surfaces to receive Firestopping.
- B. Follow Primer Manufacturer's instructions.

3.05 FIRESTOPPING INSTALLATION

- A. Follow Manufacturer's instructions and Building Code requirements.
- B. Fill Openings as required to ensure effective Fire and Smoke Barrier.
- C. Install flush with adjacent Surface.
- D. Remove excess Firestopping and any Masking Materials.
- E. Leave exposed Surfaces neat and smooth.

3.06 PRODUCT CLEANING & REPAIRING

- A. Including Work of other Trades, clean, repair and touch-up, or replace when directed, Products which have been soiled, discolored, or damaged by Work of this Section.
- B. When removing spilled or excess Firestopping, do not damage adjacent Surfaces.
- C. Remove Debris from Project Site upon Work completion, or sooner if directed.

END OF SECTION

SECTION 07920
JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Silicone joint sealants.
 - 2. Urethane joint sealants for sheetmetal flashing.
 - 3. Latex joint sealants.
 - 4. Acoustical joint sealants.
 - 5. Vapor retarder sealants.
- B. Related Sections:
 - 1. Division 5 Section "Architectural Joint Systems" for building expansion joints.
 - 2. Division 7 Section "Fire-Stopping" for sealing joints in fire-resistance-rated construction.
 - 3. Division 7 Section "Sheet Metal Flashing and Trim".
 - 4. Division 8 Section "Glazing" for glazing sealants.
 - 5. Division 9 Section "Gypsum Board" for sealing perimeter joints.

1.03 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

- D. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- F. Warranties: Sample of special warranties.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
- C. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
- D. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.05 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.06 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food; provide products that comply with 21 CFR 177.2600.
- C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.02 SILICONE JOINT SEALANTS

- A. Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Omniplus.
 - b. Dow Corning Corporation; 786 Mildew Resistant.
 - c. GE Advanced Materials - Silicones; Sanitary SCS1700.
 - d. May National Associates, Inc.; Bondaflex Sil 100 WF.
 - e. Tremco Incorporated; Tremsil 200 Sanitary.
 - f. Approved Equal.

2.03 URETHANE JOINT SEALANTS

- A. Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use T.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Polymeric Systems, Inc.; PSI-270.
 - b. Tremco Incorporated; Dymeric 240 FC.
 - c. Approved Equal.
- B. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:

- a. Sika Corporation, Construction Products Division; Sikaflex - 15LM.
- b. Tremco Incorporated; Vulkem 921, Dymonic FC.
- c. Approved Equal.

2.04 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Sonolac.
 - b. Bostik, Inc.; Chem-Calk 600.
 - c. May National Associates, Inc.; Bondaflex 600, Bondaflex Sil-A 700.
 - d. Pecora Corporation; AC-20+.
 - e. Schnee-Morehead, Inc.; SM 8200.
 - f. Tremco Incorporated; Tremflex 834.
 - g. Approved Equal.

2.05 VAPOR RETARDER JOINT SEALANTS

A. Acoustical Sealant: Manufacturer's standard single component, nonsag, non-hardening synthetic rubber sealant.

1. Products: Subject to compliance with requirements, provide the following:
 - a. Tremco Corporation; Acoustical Sealant.
 - b. Approved Equal.

2.06 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; AC-20 FTR, AIS-919.
 - b. USG Corporation; SHEETROCK Acoustical Sealant.
 - c. Approved Equal.

2.07 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.08 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings

- tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
 4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.
- G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.04 FIELD QUALITY CONTROL

A. Testing:

1. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
2. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

3. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
 4. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.05 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.06 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.07 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 1. Joint Locations:
 - a. Joints between metal panels.
 - b. Joints between different materials indicated.
 - c. Perimeter joints between materials listed above and frames of doors windows and louvers.
 - d. Control and expansion joints in ceilings and other overhead surfaces.
 2. Urethane Joint Sealant: Single component, nonsag, Class 100/50.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

- B. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
1. Urethane Joint Sealant: Multicomponent, nonsag, traffic grade, Class 50.
 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Vertical joints on exposed surfaces of walls and partitions.
 - d. Perimeter joints between interior wall surfaces and frames of interior doors windows.
 - e. Other joints as indicated.
 2. Joint Sealant: Acrylic based paintable latex.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Sealant Location:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Other joints as indicated.
 2. Joint Sealant: Mildew resistant, single component, nonsag, acid curing, Silicone.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Location:
 - a. Acoustical joints where indicated.
 - b. Other joints as indicated.
 2. Joint Sealant: Acoustical.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION

SECTION 08110

HOLLOW STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.01 CONTRACT CONDITIONS

- A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

1.02 EXTENT OF WORK

- A. Work under this section includes: All Doors, door frames, and adjoining glazed site lights

1.03 RELATED WORK SPECIFIED IN OTHER SECTIONS

- 07920 Joint Sealants
- 08710 Hardware
- 09250 Gypsum Board
- 09900 Painting and Finishes

1.04 REFERENCED SPECIFICATIONS

- A. Except as modified herein, conform to the following Recommended Specifications published by Steel Door Inst.; 712 Lakewood Center N.; 14600 Detroit Ave.; Cleveland, OH 44107; (216) 226-7700.
- B. Specifications can be obtained from Institute.

1.05 COORDINATION

- A. Coordinate with other Trades affecting or affected by Work of this Section.

1.06 SUBMITTALS

- A. Provide schedule of all doors and frames.
- B. Show locations, elevations, principal construction features, and dimensions of each Door type and Frame type, cut-outs, reinforcement, joints, welds, finish, anchoring, and other pertinent details.
- C. Locate and detail Field Splice Joints for any Frames too large to ship in one piece. Indicate instructions for making Field Splices.
- D. Manufacturer's published details may be substituted for Standard Stock Items, provided required information is included.

1.07 REGULATORY AGENCY REQUIREMENTS

- A. Fabricate Doors and Frames, where scheduled to be Fire-resistive, in accordance with requirements of Underwriters Laboratories, Factory Mutual, or other Agency approved by Building Official. Affix Agency Acceptance Label on each piece.

1.08 CERTIFICATE OF COMPLIANCE

- A. Furnish Certificate from Manufacturer stating that Hollow Steelwork delivered to Project conforms to these Specifications. In lieu of submitting Certificate, Manufacturer may affix Certifying Label on each Unit, as defined in Referenced Specifications.

1.09 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Protect against damage and discoloration.
- B. Remove Door Wrappings upon Jobsite delivery.
- C. Store Doors and Frames upright in protected dry area, at least 1 inch above Ground or Floor, and with at least 1/4 inch between individual pieces.
- D. Brace bottom ends of Frame Jambs against displacement.

1.10 FIELD MEASUREMENTS

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

1.11 SPECIAL WARRANTY

- A. In accordance with Supplementary Conditions, warrant the following:
 - 1. Doors against delamination for 2 years from Project Substantial Completion date.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Curries and Amweld or approved equal.

2.02 INTERIOR DOORS AND FRAMES

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Standard-Duty Doors and Frames: SDI A250.8, Level 1. At locations indicated in the Door and Frame Schedule.
 - 1. Physical Performance: Level C according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/8".
 - c. Face: Metallic-coated, cold-rolled steel sheet, minimum thickness of 20 Gauge, with minimum A40 coating. Primed

- d. Edge Construction: Model 1, Full Flush.
- e. Core: Polystyrene.

2.03 Frames:

- A. Materials: Primed, cold-rolled steel sheet, minimum thickness of 0.042 inch .
- B. Construction: Face welded.

2.04 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. At locations indicated in the Door and Frame Schedule.
 - 1. Physical Performance: Level B according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches
 - c. Face: Metallic-coated steel sheet, minimum thickness of 18 Gauge , with minimum A40 coating. Primed
 - d. Edge Construction: Model 1, Full Flush.
 - e. Core: Polystyrene.

2.05 Frames:

- A. Exterior Thermal Break
- B. Materials: Metallic-coated steel sheet, minimum thickness 14 Gauge , with minimum A40 coating
- C. Construction: Full profile welded.

2.06 ANCHORS

- A. General: Follow Referenced Specifications
- B. To Floors: Provide Base Anchors at each Jamb.
- C. To Stud Walls:
 - 1. Full Frame width and depth, welded to Frame.
 - 2. Minimum quantity:
 - a. Frames up to 7'-6" high: 3 per Jamb

2.07 FABRICATION

- A. Follow Referenced Specification.
- B. Accurately form Metal to required sizes and shapes.
- C. Minimum Reinforcement Thickness:
 - 1. At Hinges: 8 gauge.
 - 2. At Locks: 16 gauge.
 - 3. At Surface Hardware: 12 gauge.
 - 4. At Panic Devices: Fully reinforce. Thru-bolting not acceptable.
- D. Assemble Components to form smooth, flush surfaces, which do not show Weld or Fabrication Marks after painting when viewed from oblique angle. Do not use Metallic Fillers to conceal Defects.
- E. Fabricate with 26 gauge minimum Cover Boxes at Hardware Mortises.
- F. Provide High Frequency Reinforcement at top and bottom of Top Hinges.
- G. Weld Anchors to Door Frames.
- H. Fabricate with the following clearances.
 - 1. Between Doors and Frames: 1/8 inch
 - 2. Between Door Bottoms and Thresholds: 1/4 inch
 - 3. Between Door Bottoms and Floor: 3/4 inch
 - 4. Between Meeting Edges of pairs of Doors: 3/32 inch
- I. Prepare Door Frames to receive Silencers specified in Section 08710.
- J. Fabricate any exterior, out-swinging Doors with flush tops.
- K. Fabricate any closed-section Mullions with internal Web Reinforcement.

2.08 SHOP FINISH

- A. Dress Surface irregularities to smooth surface.
- B. Chemically treat and clean exposed Surfaces.
- C. Treatment:
 - 1. Exterior Surface of Doors & Frames: Galvanized and primed for field painting.
 - 2. Interior Surface of Door Frames: 1/16 inch minimum thickness Automotive Undercoating

PART 3 - EXECUTION

3.01 EXISTING CONDITIONS

- A. Verify that Openings to receive Hollow Steelwork are accurately sized and located, square, plumb, and otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.

C. Do not start Work until conditions are satisfactory.

3.02 PROTECTING WORK OF OTHER SECTIONS

A. Protect against damage and discoloration caused by Work of this Section.

3.03 INSTALLATION

A. Follow Referenced Specifications and Manufacturer's instructions.

B. Secure Anchors to Adjacent Construction.

C. Set Frames true with Adjacent Construction.

D. Accurately position Work.

E. Set Doors flush with Frame face.

F. Set Doors plumb to hold any desired position.

3.04 ADJUSTMENTS

A. Adjust Moving Parts to operate satisfactorily at time of Project Substantial Completion and during Warranty Period.

3.05 PRODUCT CLEANING AND REPAIRING

A. Including Work of other Trades, clean, repair and touch-up, or replace when directed, Products which have been soiled, discolored, or damaged by Work of this Section.

B. Leave surfaces ready for Finish Painting specified in Section 09900.

C. Remove Debris from Project Site upon Work completion, or sooner if directed.

END OF SECTION

SECTION 08311

ACCESS DOORS AND PANELS

PART 1- GENERAL

1.1 SECTION INCLUDES

- A. Access door and frame units, fire-rated, in wall, and ceiling locations.

1.2 RELATED SECTIONS

- A. Section 09900 - Paints and Coatings: Field paint finish.
- B. Division 15: Mechanical components requiring access.
- C. Division 16: Electrical components requiring access.

1.3 REFERENCES

- A. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.
- B. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.4 DESIGN REQUIREMENTS

- A. Fabricate floor access assemblies to support live load of 100 lb/sq ft (4.7 kPa) with deflection not to exceed 1/180 of span.

1.5 SUBMITTALS

- A. See Section 01330 - For submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Shop Drawings: Indicate exact position of all access door units.
- D. Manufacturer's Installation Instructions: Indicate installation requirements.
- E. Project Record Documents: Record actual locations of all access units.

1.6 REGULATORY REQUIREMENTS

- A. Conform to applicable code for fire rated access doors.
 - 1. Provide access doors of fire rating equivalent to the fire rated assembly in which they are to be installed.
- B. Provide products listed and labeled by UL or ITS (Warnock Hersey) as suitable for the purpose specified and indicated.

1.7 PROJECT CONDITIONS

- A. Coordinate the work with other work requiring access doors.

PART 2- PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers are limited to the following:
 - 1. Acudor Products Inc: www.acudor.com.
 - 2. Karp Associates, Inc: www.karpinc.com.
 - 3. Milcor Inc: www.milcor.com.
 - 4. Alternate Brand Request or Substitution Request required.

2.2 ACCESS DOOR UNITS - WALLS AND CEILINGS

- A. Door and Frame Units: Painted steel in all locations.
 - 1. Frames and flanges: 0.058 inch (1.5 mm) steel.
 - 2. Door panels: 0.070 inch (1.8 mm) single thickness steel sheet; 24"x24".
 - 3. Hardware:
 - a. Hinge: 175 degree stainless steel piano hinge with removable pin.
 - b. Lock: Screw driver slot for quarter turn cam lock.
 - 4. Finish:
 - a. Prime coat with alkyd primer for painted steel units.
 - b. No. 4 finish for stainless steel.
- B. Non-Fire Rated Door and Frame Units in Walls:
 - 1. In Gypsum Board on Steel Studs:
- C. Fire Rated Door and Frame Units in Walls:
 - 1. In Gypsum Board on Steel Studs:
- D. Non-Fire Rated Door and Frame Units in Ceilings:
 - 1. In Gypsum Board on Metal Furring:

PART 3- EXECUTION

3.1 EXAMINATION

- A. Verify that rough openings for door and frame are correctly sized and located.

3.2 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings. Secure rigidly in place. Align frames with adjacent walls
- C. Position units to provide convenient access to the concealed work requiring access.

END OF SECTION

SECTION 08560
VINYL WINDOWS

PART 1 - GENERAL

1.01 CONTRACT CONDITIONS

- A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

1.02 EXTENT OF WORK

- A. PVC fixed and operable windows with integral polycarbonate vandal protection panels.

1.03 RELATED SECTIONS

- 07920 Joint Sealants
12520 Window Shades

1.04 SUBMITTALS

- A. Shop Drawings: Submit shop drawings for the fabrication and installation of the window units and associated components of the work. Include wall elevations, unit elevations, and full-size section details of every typical composite member, including glazing. Data shall contain instructions for storage, handling and erection of windows.
- B. Manufacturer's Data: Submit manufacturer's specifications, standard details, and recommendations for each type of window unit required. Include information on installation, fabrication methods, finishing, hardware, glazing, and accessories. The Contractor shall submit test data in accordance with referenced standards included under this Section. The Contractor shall pay for all cost associated with obtaining required test data.
- C. Warranty: Provide written warranty from manufacturer guaranteeing his work against material and workmanship defects. Materials and delivery shall be covered in full by the manufacturer. The windows shall be guaranteed to operate under any conditions of normal temperature and humidity for project location. This includes:
1. Hardware failure of any kind for Lifetime of the product: screw stripping, frames and sashes failing in any way during normal schoolhouse use.
 2. Insulating glass shall be guaranteed against seal failures causing clouding or fogging of any kind between the glass for a period of the ten (10) years.
 3. Vinyl extrusions shall be guaranteed for a period of twenty (20) years.
- D. Operation and Maintenance Manual: Indicate manufacturer, type, style, accessory list and finishes for each type of window provided. Include Manufacturer's recommended maintenance and adjustment procedures.

1.05 QUALITY ASSURANCE

- A. All windows shall be marked an AAMA/NWWDA & N.F.R.C. certification and labeled in accordance with requirements of the applicable referenced standard.

1.06 PERFORMANCE

- A. Requirements indicated by the Drawings and these Specifications shall be considered as establishing minimum acceptable criteria and requirements as to design, function, construction, appearance, and quality.
- B. Windows shall conform to the requirements AAMA/NWWDA & N.F.R.C. of Grade F-LC80 for fixed/picture units, AP-C60 for awning windows and labeled accordingly.
- C. Thermal Performance: Glass shall be sealed insulating glazing and have .12" thick interior and exterior panes with Super Spacer, Low-E soft coat and filled with Argon gas. Overall product performance minimum allowed "U"=0.30 for casements & 0.027 for fixed picture units.

1.07 SAMPLES

- A. Submit two samples illustrating:
 - 1. Full size head jamb and sill sections for both fixed and operable conditions.
 - 2. Full size brick mold sample.
 - 3. Color samples to match those specified.
 - 4. Glazing
 - 5. Polycarbonate protection panel, attachments and weep/ventilation details.
 - 6. Gasketing
 - 7. Hardware
 - 8. Screens

PART 2 - PRODUCTS

2.01 WINDOWS

- A. Manufacturer: Northerm Windows or Approved Equal.
- B. Manufacturing Standard:
 - 1. Fixed AAMA/NWWDA F-LC80
 - 2. Awning AAMA/NWWDA AP-C60
- C. Type: Fixed and Awning
- D. Material: Extruded High Impact Resistant Rigid Polyvinyl Chloride (PVC)
- E. Construction: All corners of the frame, sash, and mullions shall be miter cut and fusion welded. Welds are to be dressed and finished to match the surrounding surfaces. Frames will be reinforced with .062 metal. Provisions for pressure equalization with baffled internal weepage shall be incorporated in the system. Profile to include large B/M with or nailing flange, which shall have slotted holes for fasteners.

1. Weather-strip: All operating sash shall be double weather stripped with extruded EPDM bulb. All weather stripping factory applied. Weather stripping shall be replaceable without the use of special tool or skills.
2. Glass and Glazing: Double glazing material: 0.12" inside and 0.12" outside of clear sealed insulating glazing and is at least 7/8" overall thickness. Sash shall be factory glazed from the interior by the use of applied PVC glazing beads with EPDM glazing gaskets. The size of the bead shall accommodate the glass thickness. Provide tempered or safety glazing where required by code or industry safety standards. Glazing to comply with Uniform Building Code.
3. Finish: Homogeneous color throughout profile material, i.e., pigment mixed with PVC prior to extrusion. Color shall be as scheduled in Division 9.
4. Screens: Operating vents shall be equipped with insect screens of aluminum-extruded frames and 18 x 14 fiberglass mesh and vinyl spline. The frames shall have a baked enamel finish to match the windows. Screens shall be removable from the inside with no special tools or knowledge.
5. Hardware: All hardware shall be heavy-duty type with "E-Gard" finish or stainless steel components, or approved equal. Ventilators shall be Encore Folding rotary crank operated with hardened steel worm gear arm with 4-bar stainless steel heavy duty hinge assembly. All screws and ancillary hardware shall be from stainless steel. Windows 24" high and over shall utilize multipoint locking hardware, operable by a single handle with 2 locking points.
6. Drywall Return: Provide 3/4" PVC return at interior side of window sill to receive finished sill specified in Section 06650 Solid Surfaces. Provide 5/8" PVC return at interior side of the window head and jamb to receive gypsum board wall returns.
7. Fasteners: Concealed non-corrosive type as recommended by window manufacturer.

F. Size and Shape: See Drawings.

G. Color: Exterior (exposed): Dark Blue; Interior (exposed): White

2.02 POLYCARBONATE PROTECTION PANEL

- A. Window protection shall be polycarbonate sheet attached to exterior of each vinyl window with aluminum frames, which provide for ventilation and moisture release between window panel and polycarbonate protection. Attach with extruded aluminum frame. Screw holes for mounting shall be oversized to allow for thermal movement. Installation shall not impair operable sash operation.
- B. Manufacturer: AUTO HAAS – Tuffak CM-2
- C. Performance Characteristics:
 1. Abrasion resistance federal motor vehicle safety standards #205 for glazing.
 2. Impact strength:
 - a. SMDO X97.1

- b. CPSC Architectural Glazing Material Safety Standards (16 CFR 1201).
- 3. Chemical Resistance:
 - a. Federal Motor Vehicle Safety Standard #206 AS4 and AS5.
 - b. Amtrack EES-101-B
- 4. Weatherability:
 - a. Federal Motor Vehicle Safety Standard #205 for glazing.
 - b. ANSI Z97.1.
 - c. Consumer Product Safety Commission's Architectural Glazing Materials Safety Standard (IGCFR 1201) Categories I and II>
- D. Other: Application of polycarbonate protection panel shall not impair operable sash operation.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with Manufacturer's instruction, approved shop drawings, and recommendations for the installation of window units, hardware, accessories, and other components of the work.
- B. Windows and glass stored on site shall be protected from extreme weather conditions and abuses from other crafts. They shall be placed in a location where handling during extreme cold conditions is not necessary.
- C. Set units plumb, level, and true to line, without warp or rack or frames or sash. Provide proper support and anchor securely in place. Windows to be factory sized to fit in each framed opening to allow ½" clearance on all sides (tolerance +/- 1/16")
- D. Adjust operating sash and hardware to provide a smooth operation with tight, weatherproof closure. Lubricate hardware and moving parts.
- E. Glazing: Comply with the window manufacturer's instructions and recommendations for the installation of glass (which has not been pre-glazed, except as otherwise indicated).
- F. Window and trim shall be installed by experienced workmen in accordance with the manufacturer's instructions and approved shop drawings.
- G. After installation, surfaces of windows and trim shall be cleaned of all paint and other contaminants. Cleaning shall be accomplished with soap and water. Non-abrasive cleaners may be used. Under no circumstances should solvents be used for cleaning.
- H. Contractor shall be responsible for protection of the work from damage by other trades or the weather and for final adjusting and cleaning. The Contractor shall also be responsible for providing warnings and instruction for care and maintenance to the Owner.

END OF SECTION

SECTION 08710

FINISH HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes:

1. Provide complete finish hardware and suitable fastenings for the Project in accordance with Drawings, Specifications, and Schedules.
2. Furnishing items of proper design for use on doors and frames of the sizes, thicknesses, profile, swing, security and similar requirements indicated, as necessary for proper installation and function.
 - a. Provide UL Listed systems for exit doors.
 - b. Provide UL Listed systems for fire rated doors where scheduled.
 - c. Provide similar systems on non-latching doors where scheduled.
3. Furnishing items not specifically mentioned, but necessary to complete the work. These are to match quality and finish of the items specified.
4. Electronic Hardware Coordination: Coordinate Work of this Section with the requirements of systems specified under Division 16, as required to provide materials, fabrication, and installation for complete and operating system meeting the operational requirements stated.

- B. Quantities: Those listed in any instance are for subcontractor's convenience only and are not guaranteed.

- C. Related Sections:

1. Section 08110 - Hollow Metal Doors and Frames

1.03 REFERENCES

- A. Standards: Current edition at date of bid.
 - 1. ADAAG - Americans with Disabilities Act, "Accessibility Guidelines for Buildings and Facilities"
 - 2. ANSI/BHMA A156.18 - Materials and Finishes
 - 3. ICC/ANSI A117.1 - Accessible and Usable Buildings and Facilities
 - 4. NFPA 80 - Standard for Fire Doors and Windows
 - 5. NFPA 252 - Standard of Fire Tests of Door Assemblies
 - 6. Underwriters Laboratories - Building Materials Directory
 - 7. Underwriters Laboratories Test Standard UL 10C - Positive Pressure Fire Tests of Door Assemblies
- B. Codes: 2006 International Building Code.

1.04 SUBMITTALS

- A. See Section 01330 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit Six (6) copies of manufacturer's data for each item of finish hardware
- C. Hardware Schedule: Submit Six (6) copies of a detailed Finish Hardware Schedule.
 - 1. The submitted Finish Hardware Schedule shall indicate the complete designation of every item required for each door or opening.
 - 2. List each opening individually under separate headings in the same order as the door schedule. Do not group like or similar doors under a single heading. Do not continue headings on separate pages.
 - 3. Each heading shall indicate opening location, handing, degree of opening, door size, type, fire rating, and Door and Frame material.
 - 4. Indicate product Manufacturer and incorporate cross-reference to symbols used in paragraph 2.14 Hardware Schedule.
 - 5. The submittal shall include an index indicating door, heading, page numbers, and locking function of each opening
 - 6. Include locations for all miscellaneous items.

7. A cross reference for any abbreviations or symbols used shall be included.
 8. Schedules in coded or horizontal format are unacceptable.
- D. Processing: Hardware schedules will not be reviewed by the Architect until they have been reviewed and approved by Contractor. The Architect will review schedule and return one copy to Contractor along with comments. Resubmit only corrected copies of those sheets requiring correction and update distributed copies with corrected sheets.
- E. Modifications: The Finish Hardware Submittal shall be kept current throughout the project duration. All revisions incorporated shall be submitted in accordance with the above requirements. Submit only cover sheet and revised pages. All revisions shall clearly identify changes from previous submittal content.
- F. Samples: If requested by the Architect, submit one (1) sample of each exposed hardware category, finished as required, and tagged with full description for coordination with the hardware schedule. Samples will be reviewed, by the Architect, for design and finish only, compliance with other requirements is the responsibility of the Contractor. Units which are acceptable and remain undamaged through submittal procedures may be used on the project.
- G. Color Samples: Submit Six (6) set of color charts and physical samples of each product requiring color selection.
- H. Key Schedule: Upon completion of the Key meeting indicated under Paragraph 2.13 C., submit Four (4) copies of a key schedule indicating the complete project key system for approval. Obtain approval prior to proceeding with lock portion of the project.
- I. Wiring Diagrams:
1. Submit Six (6) copies of electronic hardware system riser and terminal-to-terminal wiring diagrams for each Electronic Hardware application, cross-referenced to the Finish Hardware Submittal and Door Schedule.
 2. Include voltage, wire quantity and gauge requirements along with product data and installation instructions.
 3. Indicate connection points to equipment provided under Division 16.
 4. Wiring Diagrams must be produced by the product manufacturer, or prior approved firms.
- J. Operations and Maintenance Data.
1. Submittals: Submit Maintenance and Operations Manuals under provisions of Division 01 Section "Project Close Out".

2. Content: Manuals shall contain final copy of the Finish Hardware Submittal, product data, templates, Key Schedule, parts lists and diagrams, installation and maintenance instructions, and wiring diagrams.

1.05 QUALITY ASSURANCE

A. Supplier:

1. Recognized builders' hardware supplier who has been furnishing hardware in the same area as the project for a period of not less than five years.
2. Factory direct, authorized and stocking distributor of the Exit Devices, Locksets and Door Closers.
3. Employing an Architectural Hardware Consultant, certified by the Door and Hardware Institute, who is available during the course of the work to meet with the Owner, Architect or Contractor for project hardware consultation.
4. Provide certification of compliance with these requirements prior to preparation of Finish Hardware Submittals

B. Source: Obtain each kind of Hardware (Butts, Locksets, Exit Devices, Door Closers, etc.) from only one manufacturer.

C. Installer: Finish hardware shall be installed only by experienced tradesmen in compliance with trade union jurisdictions, either at the door and frame fabrication plant or at the project site.

D. Templates: Furnish hardware templates for each fabricator of doors, frames and other work to be factory prepared for the installation of hardware. Upon request, check the shop drawings of such other work to confirm that provisions will be made for the proper installation of hardware.

E. Regulatory Requirements:

1. Code Compliance: All finish hardware shall comply with applicable local and/or state current building codes. All finish hardware shall meet the requirements of ADAAG, and ICC/ANSI A117.1, Accessible and Usable Building and Facilities.
2. Product Compliance: Provide only hardware which has been tested and listed by a recognized testing agency for the types and sizes of doors required, and which complies with the requirements of the door and door frame labels. Provide Door Closers, Automatic self latching bolts, coordinators, gasketing, astragals, or other components if required to conform to label requirements.

1.06 PRODUCT HANDLING AND STORAGE

- A. Packaging: Each item or package is to be separately tagged with identification related to the final hardware schedule. Complete installation instructions shall be included in the packages.
- B. Storage: Provide a locked room at the jobsite for the storage of the hardware.

1.07 WARRANTY

- A. Coverage: Finish hardware shall be guaranteed against defects in workmanship and operation for a period of one year, backed by a factory guarantee of the hardware manufacturer. The following products shall be guaranteed for periods beyond one year:
 - 1. Locks - Two Years
 - 2. Door Closers - Ten Years
 - 3. Panic Devices - Three Years

1.08 MAINTENANCE

- A. Extra Materials: Furnish the following extra materials, which shall be delivered directly to the Owner prior to substantial completion, in accordance with Division 01 Section "Project Close Out".

<u>Quantity</u>	<u>Description</u>	<u>Factory Number</u>
Two (2)	Classroom Locksets	45H7INL15M
One (1)	Storeroom Lockset	45H7D15M
One (1)	Latchset	45H0N15M
Two (2)	Door Closers	4041-H-EDA
One (1)	Key Cabinet	RWC-125S

- B. Special Tools: Provide One (1) Set of Special Tools required for Installation and Adjustment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS AND SUBSTITUTIONS

- A. Manufacturers: Products may be furnished by the manufacturers listed under "As Specified" below, or equivalent products of type, grade, design, and function, from manufacturers listed under "Acceptable Substitutions". Requests for products not listed must be made in accordance with Division 01 Section "Product Substitutions".

<u>Product</u>	<u>As Specified</u>	<u>Acceptable Substitutions</u>
----------------	---------------------	---------------------------------

Butt Hinges	McKinney (MC)	Bommer, Hager
Locksets	Best (BE)	Approved Equal
Cylinders	Best (BE)	Approved Equal
Exit Devices	Von Duprin (VO)	Approved Equal
Door Closers	LCN (LCN)	Approved Equal
Automatic Flush Bolts	Door Controls (DC)	Approved Equal
Coordinators	Door Controls (DC)	Approved Equal
Kick & Mop Plates	Tice Industries (TI)	Rockwood, Trimco
Wall and Floor Stops	Trimco (TR)	Approved Equal
Overhead Stop and Holders	Glynn Johnson (GJ)	ABH, Rixson
Weatherstrip & Thresholds	Pemko (PE)	National Guard, Reese
Key Cabinet	Telkee	Lund
Smoke Gasket	Pemko (PE)	Approved Equal

2.02 HARDWARE MATERIALS AND FABRICATION

- A. Fasteners: Provide fasteners for installation with each hardware item. Provide Phillips head fasteners, countersunk oval, flat head, or undercut head as appropriate for material to be installed.
- B. Compatibility: Provide fasteners which are compatible with both unit fastened and substrate, and which will not cause corrosion or deterioration of hardware, base material, or fastener.

2.03 HARDWARE FINISHES

- A. Finish in general shall be: US26D Satin Chrome Plates (BHMA 626), except:
 - 1. Locksets, Exit Devices, Push Plates, Door Pulls, Overhead Stops, Kick and Mop Plates, and Exterior Butt Hinges: US32D, Satin Stainless Steel (BHMA 630).
 - 2. Interior Hinges: US26D, Satin Chrome over Steel Base (BHMA 652).
 - 3. Removable Mullions: Painted Aluminum (BHMA 689).
 - 4. Door Closers: Painted Aluminum (BHMA 689).
 - 5. Smoke Gasketing: As Selected.
 - 6. Threshold, Weatherstrip & Door Bottoms: As listed

2.04 BUTTS HINGES

- A. Quantity (per Leaf):
 - 1. Door openings up to 60": 2 each
 - 2. Door openings 60 to 90": 3 each
 - 3. Doors over 90": Furnish one additional for each 30" increment or fraction thereof.
- B. Sizes:
 - 1. 1-3/4" Exterior & Vestibule Doors: 5 x 4-1/2"
 - 2. 1-3/4" Interior Doors up to and including 36": 4-1/2 x 4-1/2"
 - 3. 1-3/4" Interior Doors over 36": 5 x 4-1/2"
- C. Pins: All doors to have non-removable pins (NRP - Set Screw in Barrel)
- D. Width: Width of Hinges shall be as required to clear projecting trim or other conditions to allow maximum degree of opening
- E. Tips: Hinges shall have Flat Button Tips.
- F. Non-Standard Sizes: For unusual size or weight doors, furnish type, size and quantity recommended by the hinge manufacturer.

2.05 LOCKSETS AND CYLINDERS

- A. Lever Design: Furnish all Lever Handle Locksets and Latches in 15M Design
- B. Backset: 2-3/4"
- C. Ratings: All Locksets and Latchsets shall be listed with Underwriters Laboratories for A label and lesser class doors.
- D. Cylinders:
 - 1. Furnish all Locksets and Cylinders with Key Removable Interchangeable Cores.
 - 2. Provide appropriate cylinder type, length, collars, and cam type to operate specified Locksets and Exit Devices.
- E. Strikes: Provide Curved Lip Strikes with adequate projection to protect door trim. Provide flat, flush lip strikes for pairs of doors with overlapping Astragals.

- F. Strike Boxes: Provide manufacturers standard wrought or plastic strike boxes.

2.06 AUTOMATIC OPERATORS AND ACCESSORIES

- A. Types required are indicated as AO1, AO2 etc. under 2.15 Hardware Groups and as described below.
1. Locate Wall Plate Actuators and Key Switch as noted in the Architectural Drawings or as directed by Architect.
 2. All System Wiring shall be concealed in the Wall and Door Frame.
 3. Coordinate Wiring requirements with Electrical sub-contractor.
 4. Wiring Diagrams: Submit Wiring Diagrams in accordance with Paragraph 1.04 Wiring Diagrams. Provide one (1) each System Riser and Wiring Diagram for each application.

Symbol	Function Description	Factory Number
AO1	Automatic Operator/Door Closers (2)	4642
	Wall Plate Actuators (2)	7910-956
	System Wiring Diagram	

Function: Depressing outside or inside Wall Plate Actuator initiates Operators opening cycle.

2.07 EXIT DEVICES

- A. Wood Doors: Furnish Sex Nuts and Bolts at Wood Composite and Mineral Core Door applications.
- B. Rated Openings: Provide UL listed Fire Exit Devices at rated openings.
- C. Sizes: Provide Exit Devices sized in accordance with the manufacturer manufacturers recommendations.
- D. Backset: Locate all Surface Vertical Rod Exit Devices with adequate Backset to allow for mounting of Meeting Stile Seals without notching for trim.
- E. Removable Mullions: Provide Mullion Spacer Blocks for installation in narrow stop frames.
- F. Vision Frames: Provide Glass Bead Kits where interference with vision frames occurs.

- G. Lever Trim: Exit Device Lever Trim shall match design specified under 2.05.A.

2.08 DOOR CLOSERS

- A. Drop Plates: Furnish drop plates where doors have insufficient height top rails, or where Regular Arm Door Closers are used in conjunction with Concealed Overhead Stops.
- B. Fluid: Furnish cold weather fluid, at exterior & vestibule doors. Furnish non-flammable fluid at fire rated openings in conformance with UL Test Standard 10C.
- C. Voltage: Coordinate voltage and location requirements for Electronic Door Closers with Electrical Sub-contractor.
- D. Spacer Blocks: Furnish Spacer Blocks where frame stop does not provide for adequate support for the parallel arm soffit shoe.
- E. Special Mounting: Provide special closer mounting as required where interference with weatherstrip or sound seals occurs.
- F. Shoulder Through Bolts: Furnish Shoulder Through Bolts for all Wood Composite and Mineral Core applications.

2.09 KICK, MOP, AND ARMOR PLATES

- A. General: Kick Plates shall be applied to the Push Side of the Door, Mop Plate applied to the Pull Side.
- B. Height: Kick Plates, 10", Mop Plates 10", Armor Plates 34".
- C. Fasteners: Provide stainless steel Phillips oval/undercut head, full tread type sheet metal screws for fastening not more than 5 inches on center.
- D. Beveling: Plates shall be beveled four edges (B4E).
- E. Width: Plates shall be furnished with width as required to provide 1/4" clearance at sides of doors, stops, weatherstrip, or sound seals.

2.10 STOPS AND HOLDERS

- A. Size: Furnish Overhead Stop and Holders sized as recommended by manufacturer.
- B. Special Applications: Furnish Overhead Stop and Holders with special shims, brackets, or special template mounting where required.
- C. Site Conditions: Where wall stops are not applicable, furnish floor stops 1215CKU, or Overhead Stops if required.

2.11 THRESHOLDS

- A. Fasteners: Furnish Thresholds with FHSL14200, ¼-20 x 2” Phillips Flat Head Sleeve Anchors.

2.12 WEATHERSTRIP AND SMOKE GASKETING

- A. General: Furnish weatherstrip and gaskets for complete perimeter of opening, including mullions, and astragals. Furnish weatherstrip at sill of Four (4) sided frames.
- B. Rain Drips: Rain Drips shall be full width of opening including frame faces.

2.13 DOOR SILENCERS

- A. General: Furnish Rubber Door Silencers for all openings not specified to have Smoke Gasketing or Weatherstrip.
- B. Quantity: Furnish three (3) for each single door frame, and four (4) for each pair of door frames.
- C. Type: 1229A.

2.14 KEYING

- A. All Keyed products (Locksets, Cylinders, Deadlocks, etc.) for this project shall be keyed to the existing factory registered Grand Master key system.
- B. Provide Brass Construction Cores and Keys during the construction period. Plastic Construction Cores are unacceptable.
- C. The Finish Hardware Supplier shall meet with the Owner to prepare the permanent keying schedule. Submit Schedule for approval in accordance with Paragraph 1.04 H.
- D. The Permanent Cores, Change Keys, and Control Keys, prepared according to the approved keying schedule, shall be transmitted directly to the Owner, prior to substantial completion. The General Contractor shall remove the construction cores and install the permanent cores. All Construction Cores shall be returned to the Finish Hardware Supplier.
- E. All Permanent Cores and Keys shall be sent direct from the lock manufacturer via Registered Mail, Return Receipt Requested, to the Owner.
- F. Stamp all Keys “Do not Duplicate” and with change designation as directed.

G. Furnish:

1. Six (6) Building Grand Master Keys
2. Six (6) Master Keys per Set
3. Four (4) change keys per Lockset or Cylinder.
4. Two (2) Control Keys
5. Two (2) Construction Control Keys
6. Twelve (12) Construction Keys

2.15 SMOKE FIRE GASKET

- A. Smoke Gasket: Pemko, HSS2000 Hot Smoke Seal

2.16 HARDWARE GROUPS

** Indicates components requiring coordination with Division 16.

HW-1

Doors 1A, 1B, 7A, 10A

1	Automatic Operator	LCN	4642 (Door 10A Only)
2	Wall Plate Activation Switches	LCN	7910- (Door 10A Only)
1	Sets Anchor Hinges	MC	TA394
1	Exit Device	VO	CD98NL
1	Rim Cylinder	BE	1E72
1	Exit Device	VO	CD98DT
1	Mortise Cylinder	BE	1E74
1	Door Closer	LCN	4041-EDA x ST1330
1	Overhead Stop	GJ	100S Series
1	Kick Plates	TI	B4EKP
1	Threshold	PE	253x4_FG x Pemkote
1	Set Weatherstrip	PE	35061CNB (Head & Jambs)
1	Door Sweeps	PE	18100CNB x SS/SMS

HW-2

Doors #8, 9

3	Each Hinges	MC	T4A3786
1	Classroom Lockset	BE	45H7R15M
1	Smoke Gasket	PE	HSS2000
1	Door Closer	LCN	4041-EDA1
1	Kick Plate	TI	B4EKP
1	Mop Plate	TI	B4EMP
1	Wall Stop	TR	1270CX-SV
3	Silencers		

HW- 3

Doors #4B, 5B, 3, 6, 11

3	Each Hinges	MC	TA2714
1	Storeroom Lockset	BE	45H7D15M
1	Overhead Stop	GJ	90S Series
3	Silencers		

HW- 4

Doors #7B, 10B

1	Automatic Operator	LCN	4642 (Door 10B Only)
2	Wall Plate Activation Switches	LCN	7910- (Door 10B Only)

1	Each Hinges	MC	T4A3786
1	Push Bar	VO	330
1	Door Pull	VO	990DT
1	Door Closer	LCN	4041-EDA
1	Floor Stop	TR	1215CKU
1	Kick Plate	TI	B4EKP
1	Set Gasket	PE	S88D

HW- 5

Doors #4A, 5A

1	Each Hinges	MC	T4A3786
1	Push Plate	VO	
1	Door Pull	VO	
1	Door Closer	LCN	4041-EDA
1	Floor Stop	TR	1215CKU
1	Kick Plate	TI	B4EKP

HW- 6

Door #12,

6	Each Hinges	MC	T4A3786
2	Exit Devices	VO	CD98L
2	Rim Cylinders	BE	1E72
2	Mortise Cylinders	BE	1E74
1	Removable Mullion	VO	KR4954 x 154
1	Cylinder (Mullion)	BE	1E74
2	Door Closers	LCN	4041-H-EDA
1	Door Closer	LCN	4041 Spring-H-CUSH
2	Kick Plates	TI	B4EKP
1	Wall Stop	TR	1270CX-SV
1	Smoke Gasket	PE	HSS2000
4	Silencers		

PART 3 - EXECUTION

3.01 PREPARATION

- A. Examination: Examine Doors, Frames, and related items for conditions that would prevent the proper application of the Finish Hardware. Do not proceed until defects are corrected.
- B. Blocking: Provide solid blocking for all wall mounted components.
- C. Fasteners: Check all conditions and use fastening devices as needed to securely anchor all hardware as per manufacturer's published templates. Self-tapping sheet metal screws are not acceptable. All Door Closers, Exit Devices, and Surface Overhead Stops shall be mounted with Sex Bolts.

3.02 INSTALLATION

- A. Mounting Heights: Mounting Heights: Mount units at heights as recommended in "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames (2001)" by Doors and Hardware Institute, except as indicated below. Products not specifically covered shall be installed in accordance with the manufacturer templates and instructions.
1. Hinges:
 - a. Top Hinge: 7-1/4", Top of frame rabbet to centerline of hinge.
 - b. Bottom Hinge: 12-1/4", Bottom of Frame to centerline of hinge
 - c. Intermediate Hinges: Centered, equal spacing between top and bottom hinges.
 2. Mortise Lock Strikes: 40", bottom of frame to centerline of Strike.
 3. Deadlocks: 48", bottom of frame to centerline of Cylinder.
 4. Wall Stops: Locate Wall Stops intended for use with Lever Handle Locksets and Exit Devices at the Centerline of the Spindle or Pull.
- B Installation: Install each hardware item in compliance with manufacturer's instructions.
1. Cutting and Fitting: Wherever cutting and fitting are required to install hardware surfaces which will be painted or finished at a later time, install each item completely and then remove and store in a secure place. After completion of the finishes, re-install each item.
 2. Door and Frame Finishes: Do not install surface-mounted items until finishes have been completed on the substrate.
 3. Fire Rated Openings: Install in accordance with NFPA 80.
 4. Exit Devices: Trim Exit Devices to provide 1-1/2" clearance between End Cap and hinge jamb stop face and/or stop applied weatherstrip.
 5. Door Closers: Door Closer shall be located to allow maximum degree of opening that project conditions will allow. Door Closer shall not be used to stop the door, except for models equipped with an integral stop-on-the-arm feature.
 6. Overhead Stops: Furnish Overhead Stop and Holders with maximum degree of opening that project conditions will allow.
 7. Floor Stops: Locate Floors Stops at maximum degree of opening that project conditions will allow. Do not locate Floor Stops where they create a hazardous condition. Stops should be located no more than 1/3 Door width from the latch edge

of the Door. Do not attach Thresholds that provide transition from Concrete to Wood Floors on Wood Floor side of opening.

8. Thresholds: Set all Exterior Thresholds in a bed of butyl rubber sealant in conformance with Division 7 requirements. Remove all excess sealant. Caulk all Edges and Joints to exclude moisture.
 9. Weatherstrip: Mount and adjust Rigid Jamb Weatherstrip prior to mounting Parallel Arm Door Closers and Rim Exit Devices. Weatherstrip shall be installed to provide a continuous seal at head and jambs. Do not notch Weatherstrip for Door Closer shoe. Provide Parallel Arm 5th hole spacer of increased thickness to allow for revised location.
- C. Adjustment: Adjust and check each operating item of hardware and each door to insure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly.

3.03 FINAL ADJUSTMENT

- A. Final Adjustment: Wherever hardware installation is made more than one (1) month prior to acceptance or occupancy, make a final check and adjustment of all hardware items during the week prior to acceptance or occupancy. Clean and lubricate 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.
- B. Door Closer Adjustment: After mechanical systems have been balanced, adjust Door Closers to comply with following ICC/ANSI A117.1 requirements.
1. Closing Speed: With the door open 70 degrees, the door closer shall be adjusted so that the door will take at least three (3) seconds to move to a point where the leading edge of the door is inches three from latching.
 2. Opening Force: The maximum force for pushing or pulling a door open shall be as follows: (these forces do not apply to the force required to retract latch bolts or disengage other devices securing the door)
 - a. Fire Doors: The minimum opening force allowable by the appropriate administrative authority.
 - b. Exterior Doors: 10.0 lbf.
 - c. Interior Doors: 5.0 lbf.
- C. Instruction: Instruct Owner's Personnel in proper adjustment and maintenance of hardware and hardware finishes

Mertarvik Emergency Evacuation Center
AKSAS #52329

08710
FINISH HARDWARE

END OF SECTION

SECTION 08800

GLAZING

PART 1 - GENERAL

1.01 CONTRACT CONDITIONS

- A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

1.02 EXTENT OF WORK

- A. This section includes all internal and external glazing except for vinyl windows as specified in Section 08560.

1.03 RELATED SECTIONS

- 07920 Joint Sealants
- 08110 Hollow Steel Doors and Frames

1.04 SECTION REQUIREMENTS

- A. Submittals: Products Data and 12-inch square samples.
- B. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
- C. Comply with written instructions of glass product manufacturers; GANA's "Glazing Manual"; and publications of GANA, AAMA, and SIGMA as applicable to products indicated, unless more stringent requirements are indicated.
- D. Insulating-Glass Units: Permanently mark with appropriate certification label on one of the inspecting and testing agencies indicated below:
 - 1. Insulating Glass Certification Council
 - 2. Associated Laboratories, Inc.
 - 3. National Accreditation and Management Institute

1.05 WARRANTY

- A. See Section 01770 Closeout Procedures, for additional warranty requirements.
- B. Provide a five (5) year warranty to include coverage for sealed glass units from seal failure, interpane dusting or misting, and replacement of same.

PART 2 - PRODUCTS

2.01 TEMPERED GLASS

- A. ASTM C 1048, Type II, Class 1, Form 3, Quality q8, Kind FT, Finish fl. Applies to all single glazing.

2.02 LAMINATED GLASS

- A. Two sheets of 3.0 mm thick Float Glass, with polyvinyl butyryl sheet interlayer. Comply with ASTM C 1172.

2.03 INSULATING-GLASS UNITS

- A. Pre-assembled units complying with ASTM E 774 for Class CBA units, with two 6.0 mm thick sheets of glass separated by a ½ inch dehydrated space filled with argon.
 - 1. Inboard Lite: Laminated Glass at all doors and curtain wall. Winter nighttime U = 0.29.
 - 2. Laminated Glass on exterior doors and sidelights.
 - 3. Outboard Lite: Tempered at Curtain Wall.
 - 4. Low-Emissivity Coating: Inboard Surface.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine framing glazing, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep system.
 - 3. Minimum required face or edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.03 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

- G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm) as follows:
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.04 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.05 PROTECTION AND CLEANING

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION

SECTION 09250

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Shaft wall system.
- B. Fire rated walls.
- C. Gypsum wallboard.
- D. Joint treatment and accessories.
- E. Textured finish system.

1.02 RELATED SECTIONS

- B. Section 07920 - Joint Sealers: Acoustic sealant.

1.03 REFERENCES

- A. ASTM C 36/C 36M - Standard Specification for Gypsum Wallboard; 2001.
- B. ASTM C 442/C 442M - Standard Specification for Gypsum Backing Board, Gypsum Coreboard, and Gypsum Shaftliner Board; 1999a.
- C. ASTM C 475/C 475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2002.
- D. ASTM C 840 - Standard Specification for Application and Finishing of Gypsum Board; 2002.
- E. ASTM C 1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2001.
- F. ASTM C 1396/C 1396M - Standard Specification for Gypsum Board; 2002.
- G. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2001.
- H. GA-253 - Recommended Specifications for the Application of Gypsum Sheathing; Gypsum Association; 1999.
- I. GA-600 - Fire Resistance Design Manual; Gypsum Association; 2003.

1.04 SYSTEM DESCRIPTION

- A. Acoustic Attenuation for Interior Partitions: STC of 45-49 calculated in accordance with ASTM E 413, based on tests conducted in accordance with ASTM E 90.

1.05 SUBMITTALS

- A. See Section 01330 - For submittal procedures.
- B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
- C. Product Data: Provide data on gypsum board, accessories, and joint finishing system.

1.06 QUALITY ASSURANCE

- A. Perform in accordance with ASTM C 840. Comply with requirements of GA-600 for

fire-rated assemblies.

1.07 REGULATORY REQUIREMENTS

- A. Conform to applicable code for fire rated assemblies as indicated on drawings.

PART 2 - PRODUCTS

2.01 GYPSUM BOARD MATERIALS

- A. Acceptable Manufacturers are limited to the following:
 - 1. G-P Gypsum Corporation: www.gp.com.
 - 2. National Gypsum Company: www.nationalgypsum.com.
 - 3. USG Corporation: www.usg.com.
 - 4. Alternate Brand Request or Substitution Request required.
- B. Gypsum Wallboard: ASTM C 36/C 36M and ASTM C 1396/C 1396M. Sizes to minimize joints in place; ends square cut. All Gypsum board to be Type X
 - 1. Type X: Fire resistant, UL or WH rated.
 - a. Application: Where required for fire-rated assemblies, unless otherwise indicated.
 - b. Thickness: 5/8 inch (16 mm).
 - c. Edges: Tapered.

2.02 ACCESSORIES

- A. Acoustic Sealant: As specified in Section 07920.
- B. Fire Rated Deflection track:
 - 1. Manufacturer: Blaze Frame,
 - 2. Product: 2" MC (DLZ)
 - 3. Application: UD2, for Perpendicular Unprotected Deck
 - 4. UL Listing: HW-D-0513
- C. Building Paper: Asphalt impregnated building felt conforming to ASTM D 226, Type I.
- D. Finishing Accessories: ASTM C 1047, galvanized steel or rolled zinc, unless otherwise indicated.
 - 1. Types: As detailed or required for finished appearance.
 - 2. Special Shapes: In addition to conventional cornerbead and control joints, provide U-bead at exposed panel edges.
- E. Joint Materials: ASTM C 475 and as recommended by gypsum board manufacturer for project conditions.
 - 1. Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
 - 2. Ready-mixed vinyl-based joint compound.
 - 3. Powder-type vinyl-based joint compound.
 - 4. Chemical hardening type compound.
- F. Textured Finish Materials: Latex-based compound; plain.
- G. Anchorage to Substrate: Tie wire, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
 - 1. In non-fire-rated construction, seal around all penetrations by conduit, pipe, ducts, and rough-in boxes.

3.03 GYPSUM BOARD AND GLASS MAT FACED BOARD INSTALLATION

- A. Comply with ASTM C 840 and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
 - 1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated.

3.06 JOINT TREATMENT

- A. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).
 - 2. Taping, filling and sanding is not required at base layer of double layer applications.

3.07 Deleted

3.08 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

3.09 FINISH LEVEL SCHEDULE

- A. Level 1: Above finished ceilings concealed from view.
- B. Level 2: Utility areas and areas behind cabinetry.
- C. Level 4: Walls and ceilings scheduled to receive flat or eggshell paint finish.
- D. Level 5: Walls and ceilings scheduled to receive semi-gloss or gloss paint finish.

END OF SECTION

SECTION 09650

RESILIENT FLOORING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. All required floor and wall base preparation to properly install products included in this specification.
- B. Resilient base.
- C. Rubber stair treads, risers, and nosings.
- D. Installation accessories.

1.02 RELATED SECTIONS

- A. Section 06100 - Rough Carpentry; plywood substrate; surface tolerances.

1.03 REFERENCES

- A. ASTM E 648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2003.
- B. ASTM F 710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 1998.
- C. ASTM F 1861 - Standard Specification for Resilient Wall Base; 2002.
- D. ASTM F 1913 - Standard Specification for Vinyl Sheet Floor Covering Without Backing; 2002.
- E. FS RR-T-650 - Treads, Metallic and Nonmetallic, Skid Resistant; Federal Specifications and Standards; Revision E, 1994.
- F. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; National Fire Protection Association; 2000.

1.04 SUBMITTALS

- A. See Section 01330 - For submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Shop Drawings: Indicate seaming plan.
- D. Selection Samples: Submit manufacturer's complete set of flooring and seam weld color samples for Prime Consultant's initial selection.
- E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.05 DELIVERY, STORAGE, AND PROTECTION

- A. Protect roll materials from damage by storing on end.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).
- B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

1.07 EXTRA MATERIALS

- A. Furnish full size units equal to 2 percent of quantity of resilient flooring installed as extra materials. Properly label and package extra materials. Deliver to Owner's designated storage area.
- B. Provide 100sq ft of flooring, 100 lineal feet of base for each type and color specified.

1.08 WARRANTY

- A. See Closeout Procedures, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MATERIALS - TILE FLOORING

- A. Rubber Tile Flooring: Rubber compound with natural fillers and color pigments
 1. Critical Radiant Flux (CRF): Minimum 0.45 cm² or more (Class 1) when tested in accordance with ASTM E 648 or NFPA 253.
 2. Total Thickness: 0.14 inch (3.5 mm)
 4. Tile Deimensions: 40 inches by 20 inches
 5. Static Load Limit: ASTM F970 Standard test passes 800 lbs, < 0.0005
 6. Coefficient of Friction: Complies with ADA requirements for accessible routes -- ASTM D 2047 > 0.5
 7. Color/Pattern: As selected from manufacturers full color line.
 9. Acceptable Manufacturers are limited to the following:
 - a. Nora Systems ; Basis of Design:
 - b. or Approved Equal.

2.02 MATERIALS - BASE

- A. Resilient Base: ASTM F 1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove, and as follows:
 1. Height: 4 inch (100 mm).
 2. Thickness: 0.125 inch (3.2 mm) thick.
 3. Finish: Satin.
 4. Length: Roll.
 5. Color: Color as selected from manufacturer's standards.
 6. Accessories: Premolded external corners and end stops.
 7. Acceptable Manufacturers are limited to the following:

- a. Johnsonite, Inc; Basis of Design: www.johnsonite.com.
- b. BurkeMercer Flooring Products, Inc: www.burkemercer.com.
- c. Roppe Corp: www.roppe.com.
- d. Alternate Brand Request or Substitution Request required.

2.03 MATERIALS - STAIR LANDINGS, TREADS, RISERS, AND NOSINGS

- A. Rubber Landings, Treads, Risers, and Nosings: ASTM developed F-2169 Standard Specification for Resilient Stair Treads in 2002, Type TS rubber, and as follows:
1. Stair Tread Size: Single-piece units for width of stair treads, or equal length units if tread width exceeds available manufacturer's length.
 2. Stair Tread Thickness: Minimum 1/4-inch nominal.
 3. Stair Riser Size: Single-piece units for height and width of stair risers, or equal sized units if riser width exceeds available manufacturer's length.
 4. Stair Riser Thickness: Minimum 1/8-inch nominal.
 5. Stair Stringer Skirt: Cut to match riser and tread, meet wall base height, same material and color base.
 6. Color: Color as selected from manufacturer's standards.
 7. Acceptable Manufacturers are limited to the following:
 - a. Johnsonite, Inc; Basis of Design: Raised Square: www.johnsonite.com.
 - b. BurkeMercer Flooring Products, Inc: www.burkemercer.com.
 - c. Roppe Corp: www.roppe.com.
 - d. Alternate Brand Request or Substitution Request required.

2.03 UNDERLAYMENT

- A. Halex / Multiply Baltic birch (www.halexcorp.com) underlayment panels, exterior grade laminated wood panel. Solid core, sanded surface, no open knots, all knots over 1/4" in diameter plugged with solid wood. Synthetic patches will not be acceptable. Units shall be assembled with exterior grade phenolic resin glue, which passes 2 hour boil test. The panels shall conform to the following:

1. Grade:	Exterior grade - Exposure 1
2. Thickness:	1/4" (6mm), 3/8" (9mm)
3. Sizes:	4'x4', 4'x5', 4'x8'
4. Density:	45.5 pounds per cubic foot
5. Hardness:	1,367 lbf (ASTM D1037)
6. Internal Bond:	370 psi (ASTM D1037)
7. Squareness:	Adjoining sides will be perpendicular within + 1/32 inch.
8. Plies:	1/4" (6mm) - 5 ply laminated birch panel 3/8" (9mm) - 7 ply laminated birch panel
9. Flexural Strength:	1/4" (6mm) 13,165 psi (ASTM C1185) 3/8" (9mm) 14,375 psi (ASTM C1185)
10. Fastener Holding Power:	1/4" (6mm) 378 lbf (ASTM D1037) 3/8" (9mm) 520 lbf (ASTM D1037)

- B. Fasteners:
1. Nails: 12 gauge galvanized ring shank underlayment nails with a 3/16 inch diameter head.

2. Staples: 18 gauge galvanized or clear coated chisel point staples with 1/4 inch maximum crown.
 3. Length: The length of the fastener shall be long enough to penetrate at least 75 percent of the subfloor, but not protrude through the bottom side of the subfloor.
4. Do not use uncoated, cement coated or rosin coated fasteners.

2.04 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.
- C. Edge Strips: Minimum 1/8-inch and 1-inch wide, rubber composition, tapered or bullnose edge, color to match flooring.
- D. Filler for Coved Base: Plastic.
- E. Sealer: Types recommended by flooring manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that wall surfaces are smooth and flat within tolerances specified in Section 09260, are dust-free, and are ready to receive resilient base.
- B. Verify that sub-floor surfaces are dust-free, and free of substances which would impair bonding of adhesive materials to sub-floor surfaces.
- C. Verify that concrete sub-floor surfaces are ready for resilient flooring installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within the following limits:
 1. Moisture emission rate: Not greater than 3 lb per 1000 sq ft (7.1 kg per 100 sq m) per 24 hours when tested using calcium chloride moisture test kit for 72 hours.
 2. Alkalinity: pH range of 5-9.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.
- B. Prohibit traffic until filler is cured.
- C. Clean substrate.
- D. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION - SHEET FLOORING

- A. Install in accordance with manufacturer's instructions.
- B. Set flooring in place; press with heavy roller to attain full adhesion.

- C. Lay flooring with joints and seams parallel to longer room dimensions, to produce minimum number of seams. Lay out seams to avoid widths less than 1/3 of roll width; match patterns carefully at seams.
- D. Double cut sheet; provide heat welded seams.
- E. Where floor finishes are different on opposite sides of door, terminate flooring under centerline of door.
- F. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated. Secure metal strips after installation of flooring with stainless steel screws. Secure resilient strips by adhesive.
- G. Coved Base: Install as detailed on drawings, using coved base filler as backing at floor to wall junction. Extend sheet flooring vertically to height indicated, and cover top edge with metal cap strip.
- H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- I. Install flooring in recessed floor access covers. Maintain floor pattern.

3.04 INSTALLATION - TILE FLOORING

- A. Install in accordance with manufacturer's instructions.
- B. Mix tile from container to ensure shade variations are consistent when tile is placed.
- C. Spread only enough adhesive to permit installation of materials before initial set.
- D. Set flooring in place; press with heavy roller to attain full adhesion.
- E. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.
- F. Where floor finishes are different on opposite sides of door, terminate flooring under centerline of door.
- G. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated. Secure metal strips before installation of flooring with stainless steel screws.
- H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- I. Install flooring in recessed floor access covers. Maintain floor pattern.

3.05 INSTALLATION - BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.
- B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.

- D. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean and seal resilient flooring products in accordance with manufacturer's instructions.

3.07 PROTECTION OF FINISHED WORK

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

3.08 SCHEDULE

- A. See Room Finish Schedule and Floor Plans in Drawings for installation locations

END OF SECTION

SECTION 09900

PAINTS AND COATINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation required to properly install products.
- B. Field application of paints and other coatings.
- C. Surfaces to be finished are indicated in this section and on the Drawings.

1.02 RELATED SECTIONS

- A. Section 05500 - Metal Fabrications: Shop-primed items.
- B. Section 05510 - Metal Stairs: Shop-primed items.

1.03 REFERENCES

- A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Master Painters and Decorators Association; 2002.

1.04 SUBMITTALS

- A. See Section 01330 - For submittal procedures.
- B. Product Data: Provide complete list of all products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system (copy of relevant MPI Manual page is acceptable).
 - 4. If proposal of substitutions is allowed under submittal procedures, explanation of all substitutions proposed.
- C. Certification by manufacturer that products comply with Contract Documents and are compatible with applicable substrates and with each other.
- D. Samples: Submit three paper "drop" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
 - 2. Where sheen is not specified, discuss sheen options with Prime Consultant before preparing samples, to eliminate sheens definitely not required.
 - 3. Paint color submittals will not be considered until color submittals for major materials not to be painted have been approved.
- E. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.05 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the work of this section with minimum 5 years experience.
- B. Maintain one copy of relevant portions of MPI Architectural Painting Specification Manual on project site at all times.
- C. Material Safety Data Sheets: At project site maintain file of MSDS sheets for each product used; become familiar with and follow manufacturer's stated application and safety requirements.

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 45 degrees F (7 degrees C) for interiors; 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

1.08 EXTRA MATERIALS

- A. See Product Requirements, for additional provisions.
- B. Supply 1 gallon (4 L) of each color; store where directed.
- C. Label each container with color in addition to the manufacturer's label.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.
- B. Provide all paint and coating products from the same manufacturer to the greatest extent

possible.

C. Acceptable Manufacturers are limited to the following:

1. Duron, Inc: www.duron.com.
2. ICI Paints North America: www.icidecorativepaints.com.
3. Benjamin Moore & Co: www.benjaminmoore.com.

2.02 MATERIALS

- A. Paints and Coatings: Provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI Categories, except as otherwise indicated.
1. Provide products complying with regulatory requirements for volatile organic compound (VOC) content in force in jurisdiction where project is located.
 2. Provide ready mixed paints and coatings, except field-catalyzed coatings.
 3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

2.03 PAINT SYSTEMS

- A. Provide Premium Grade systems (2 top coats) as defined in MPI Architectural Painting Specification Manual, except as otherwise indicated.

2.04 EXTERIOR PAINT SYSTEMS

- A. Structural Steel and Metal Fabrications:
1. Applications include but are not limited to doors, frames, miscellaneous metal boxes, covers, and pipes.
 2. EXT 5.1A Quick Dry Enamel: Q.D. Primer MPI #76, Q.D. Enamel MPI #81 or 96.
 - a. : Semi-gloss.
 3. EXT 5.13H Latex over w.b.primer: W.B. Primer 134, Latex #10,15,11,119

2.05 INTERIOR PAINT SYSTEMS

- A. Structural Steel and Metal Fabrications:
1. INT 5.1A Quick Dry Enamel: Q.D. Primer MPI #95, Q.D. Enamel MPI #81, semi-gloss.
 2. INT 5.1B W.B. Light Industrial Coating: Rust Inhibitive Primer MPI #19, W.B. Light Industrial Coating MPI #110, gloss level 3.
 3. INT 5.1T Alkyd: Surface Tolerant Primer MPI #23, Alkyd MPI #47, semi-gloss.
 4. INT 5.1V Epoxy: Self Priming Epoxy MPI #120, Epoxy MPI #77, gloss.
 5. INT 5.1W Alkyd: Q.D. Shop Primer MPI #275, Alkyd MPI #47, semi-gloss.
- B. Steel Subject to High Temperatures:
1. Applications include but are not limited to stacks and piping.

2. INT 5.2A Heat Resistant Enamel: Heat Resistant Enamel MPI #21, gloss.
- C. Galvanized Metal, Not Chromate Passivated:
 1. Applications include but are not limited to doors, frames, railings, and piping.
 2. INT 5.3E Epoxy: (Vinyl) Wash Primer MPI #80, Epoxy Primer MPI #101, Epoxy MPI #77, gloss.
- D. Glue Laminated Beams:
 1. Applications include but are not limited trim, Glue Laminated Beams.
 2. INT 6.1D Polyurethane Varnish: Polyurethane 56, 57
- E. Woodwork
 1. Applications include but are not limited to paneling, casework, and trim:
 2. INT 6.2J Polyurethane Varnish over Stain: Wood Stain #90, Polyurethane #56, 57
- F. Gypsum Board:
 1. Applications include but are not limited to walls, ceilings.
 2. INT 9.2B High Performance Architectural Latex: Latex Primer Sealer MPI #50, HIPAC Latex MPI #139, gloss level 3.

2.06 REFLECTIVE EMERGENCY TAPE

- A. Refeective Emergency Tape: 3M Emergency and Egress Markings Tape, Photoluminescent material

PART 3 - EXECUTION

3.01 SCOPE -- SURFACES TO BE FINISHED

- A. Paint all exposed surfaces except where indicated not to be painted or to remain natural; the term "exposed" includes areas visible through permanent and built-in fixtures when they are in place.
- B. Paint the surfaces described in PART 2, indicated on the Drawings, and as follows:
 1. If a surface, material, or item is not specifically mentioned, paint in the same manner as similar surfaces, materials, or items, regardless of whether colors are indicated or not.
 2. Paint surfaces behind movable equipment and furnishings the same as similar exposed surfaces.
 3. Paint surfaces to be concealed behind permanently installed fixtures, equipment, and furnishings, using primer only, prior to installation of the permanent item.
 4. Paint back sides of access panels and removable and hinged covers to match exposed surfaces.
 5. Finish top, bottom, and side edges of exterior doors the same as exposed faces.
 6. Paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, and hangers, brackets, collars and supports occurring in finished areas to match background surfaces, unless otherwise indicated.
 7. Paint equipment, piping, conduit, and exposed duct work in utility areas in colors according to the color schedule.
 8. Paint all mechanical and electrical equipment, including that which is factory-finished, exposed to weather or to view on the roof and outdoors.

9. Paint shop-primed mechanical and electrical items occurring in finished areas.
 10. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
 11. Paint interior surfaces of air ducts and convector and baseboard heating cabinets with flat, nonspecular black paint where visible through registers, grilles, or louvers.
 12. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
 13. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
- C. Do Not Paint or Finish the Following Items:
1. Items fully factory-finished unless specifically noted; factory-primed items are not considered factory-finished.
 2. Items indicated to receive other finish.
 3. Items indicated to remain naturally finished.
 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 5. Anodized aluminum.
 6. Polished and brushed stainless steel items.
 7. Acoustical materials.
 8. Concealed piping, ductwork, and conduit.

3.02 EXAMINATION

- A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials; report incompatible primer conditions and submit recommended changes for Prime Consultant's approval.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 1. Gypsum Board: 12 percent.
 2. Interior Wood: 15 percent, measured in accordance with ASTM D 4442.
- E. Measure the ph factor of concrete, masonry, and mortar before starting any finishing process, using the method specified in MPI Architectural Painting Manual.
 1. Report results in writing to Owner before starting work.
 2. If results of test indicate need for remedial action, provide written description of remedial action. If a different primer or paint systems is required, state the total cost of the change. Do not proceed with remedial action or change without receiving written authorization from Owner.

3.03 PREPARATION

- A. Prepare surfaces as specified in MPI Architectural Painting Specification Manual and as

follows for the applicable surface and coating; if multiple preparation treatments are specified, use as many as necessary for best results; where the Manual references external standards for preparation (e.g. SSPC standards), prepare as specified in those standards; comply with coating manufacturer's specific preparation methods or treatments, if any.

- B. Coordinate painting work with cleaning and preparation work so that dust and other contaminants do not fall on newly painted, wet surfaces.
- C. Surface Appurtenances: Prior to preparing surfaces or finishing, remove electrical plates, hardware, light fixtures, light fixture trim, escutcheons, machined surfaces, fittings, and similar items already installed that are not to be painted.
 - 1. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before preparation and finishing.
 - 2. After completing painting in each space or area, reinstall items removed using workers skilled in the trades involved.
- D. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove or repair existing coatings that exhibit surface defects.
- E. Marks: Seal with shellac those which may bleed through surface finishes.
- F. Impervious Surfaces: Remove mildew by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry..
- G. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.
- H. Insulated Coverings to be Painted: Remove dirt, grease, and oil from canvas.
- I. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- J. Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.
- K. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
- L. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.04 APPLICATION

- A. Apply products in accordance with manufacturer's instructions and as specified or recommended by MPI Manual, using the preparation, products, sheens, textures, and colors as indicated.
 - 1. Remove, refinish, or repaint work not complying with requirements.
- B. Do not apply finishes over dirt, rust, scale, grease, moisture, scuffed surfaces, or other

conditions detrimental to formation of a durable coating film; do not apply finishes to surfaces that are not dry.

- C. Use applicators and methods best suited for substrate and type of material being applied and according to manufacturer's instructions.
 - 1. Brush Application: Use brushes best suited for the type of material applied; use brush of appropriate size for the surface or item being painted; produce results free of visible brush marks.
 - 2. Roller Application: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
 - 3. Spray Application: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
 - 4. Where application method is listed in the MPI Manual for the paint system that application method is required; otherwise any application method recommended by manufacturer for material used and objects to be painted is acceptable.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate; provide total dry film thickness of entire system as recommended by manufacturer.
 - 1. Number of coats and film thickness required are the same regardless of application method.
 - 2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance.
 - 3. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent to that of flat surfaces.
- E. Apply finish to completely cover surfaces with uniform appearance without brush marks, runs, sags, laps, ropiness, holidays, spotting, cloudiness, or other surface imperfections.
 - 1. Before applying finish coats, apply a prime coat of material recommended by manufacturer, unless the surface has been prime coated by others; where evidence of suction spots or unsealed areas in first coat appear, recoat primed and sealed surfaces to ensure finish coat with no burn through or other defects due to insufficient sealing.
 - 2. Apply first coat to surface that has been cleaned, pretreated, or otherwise prepared as soon as practical after preparation and before subsequent surface deterioration.
 - 3. Do not apply succeeding coats until the previous coat has cured as recommended by manufacturer.
 - 4. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat will not cause the undercoat to lift or lose adhesion.
 - 5. If manufacturer's instructions recommend sanding to produce a smooth, even surface, sand between coats.
 - 6. Before applying next coat vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

3.05 CLEANING AND PROTECTION

- A. Collect waste material which may constitute a fire hazard, place in closed metal

- containers, and remove daily from site.
- B. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from site.
 - C. Protect other work, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting as approved by Prime Consultant.
 - D. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
 - E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in MPI Manual.

END OF SECTION

SECTION 10170

PLASTIC TOILET COMPARTMENTS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Solid plastic toilet compartments.
- B. Urinal screens.
- C. Installation accessories.

1.02 RELATED SECTIONS

- B. Section 09250 – Gypsum board Assemblies.
- C. Section 10800 - Toilet, Bath, and Laundry Accessories.

1.03 SUBMITTALS

- A. See Section 01330 - For submittal procedures.
- B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
- C. Product Data: Provide data on panel construction, hardware, and accessories.
- D. Samples: Submit two samples of partition panels, 4x4 inch in size illustrating panel finish, color, and sheen.

1.04 COORDINATION

- A. Coordinate the work with placement of support framing and anchors in wall.

1.10 WARRANTY

- A. See Section 01770 - Closeout Procedures, for additional warranty requirements.
- B. Correct defective Work within a 10 year period after Date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Plastic Toilet Compartments:
 - 1. Bobrick; Basis of Design: Sierra Series: www.bobrick.com.
 - 1. Ampco Products, Inc: www.ampco.com.
 - 2. Comtec Industries: www.comtecindustries.com.
 - 3. Santana Products Co., Inc: www.hinyhider.com.
 - 4. Substitutions: Section 01630 - Product Options and Substitutions.

2.02 COMPONENTS

- A. Toilet Compartments: Solid color reinforced composite (SCRC) panels, doors, and pilasters, horizontally braced.
- B. Door and Panel Dimensions:
 - 1. Thickness: 1 inch (25 mm).
- C. Urinal Screens: Wall mounted with continuous panel bracket

2.03 ACCESSORIES

- A. Pilaster Shoes: Formed stainless steel with satin finish, 3 in (75 mm) high, concealing floor fastenings.
 - 1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
- B. Pilaster Brackets: Satin stainless steel.
- C. Wall Brackets: Continuous type, satin stainless steel.
- E. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
 - 1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.
- F. Hardware: Satin stainless steel:
 - 1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
 - 2. Door Latch: Slide type with exterior emergency access feature.
 - 3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
 - 4. Coat hook with rubber bumper; one per compartment, mounted on door.
 - 5. Provide door pull for out swinging doors.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify correct spacing of and between plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 to 1/2 inch (9 to 13 mm) space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

3.03 ERECTION TOLERANCES

- A. Maximum Variation From True Position: 1/4 inch (6 mm).

- B. Maximum Variation From Plumb: 1/8 inch (3 mm).

3.04 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm).
- B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.
- C. Adjust adjacent components for consistency of line or plane.

3.05 SCHEDULES

- A. See Drawings for panel locations

END OF SECTION

SECTION 10441

INTERIOR SIGNAGE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Raised letter and graphic plastic signs.

1.02 RELATED SECTIONS

- A. Section 15075 - Mechanical Identification.
- B. Section 16075 - Electrical Identification.

1.03 REFERENCES

- A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 1998.

1.04 SUBMITTALS

- A. See Section 01330 - For submittal procedures.
- B. Shop Drawings: Indicate sign styles, lettering font, foreground and background colors, locations, overall dimensions of each sign.
- C. Samples: Submit two sample signs, in size illustrating type, style, letter font, and colors specified; method of attachment.

1.05 QUALITY ASSURANCE

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

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Package signs, labeled in name groups.
- B. Store adhesive attachment tape at ambient room temperatures.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Plastic Signs:
 - 1. Mohawk Sign Systems, Inc; Product series 1000 ADA - BASIS OF DESIGN: www.mohawksign.com.
 - 2. Best Manufacturing Co; Product HC300: www.bestsigns.com.
 - 3. Seton Identification Products: www.seton.com/aec.
 - 4. Substitutions: See Section 01600 - Product Requirements.

2.02 RAISED LETTER SIGNS

- A. Base Material: solid color acrylic plastic:
 - 1. Height: 3, 6 or 8 inches (72,144,204 mm).
- B. Raised Character Size and Style: Acrylic plastic, character adhered to base material:
 - 1. Comply with applicable provisions of ANSI/ICC A117.1, including Braille.
 - 2. Character Color: White.
 - 3. Character Thickness: 1/8 inch (3 mm).
 - 4. Height: 1 inch (25 mm).
 - 5. Edges: Beveled.
 - 6. Character Font: Helvetica.
 - 7. Character Case: Upper case only.

2.03 ACCESSORIES

- A. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Position sign on wall from strike side of door, level.

3.03 SCHEDULES

- A. Locker Rooms and Toilet Rooms Door Graphics: 6 inches (150 mm) high, "male" and "female" graphic image; matching room sign color. Quantity: 1 per each door accessing each toilet or locker room. Mounting location: as noted in drawings or as directed by Owner.
- B. Room Signs: Provide the following signs adjacent to the door(s) indicated. Mounting location: as noted in drawings or as directed by Owner.

Room number on drawings	Room Name English (Yup'ik)	Room number
4	Mens	XXX
5	Womens	XXX
8	Clinic	XXX
9	Washeteria	XXX
12	Mechanical	XXX
13	Generator	XXX

END OF SECTION

SECTION 10800

TOILET & BATH ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Accessories for toilet rooms.
- B. Accessories for showers.
- C. Accessories for utility rooms.

1.02 RELATED SECTIONS

- A. Section 09100: Concealed supports for accessories, including in wall framing and plates.
- B. Section 09250: Gypsum Board Assemblies.
- C. Section 15440: Plumbing Fixtures

1.03 REFERENCES

- A. ASTM A 269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2002a.
- B. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2002a.
- C. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2000.
- D. ASTM B 456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 1995.
- E. ASTM C 1036 - Standard Specification for Flat Glass; 2001.
- F. GSA CID A-A-3002 - Mirrors, Glass; U.S. General Services Administration; 1996.

1.04 SUBMITTALS

- A. See Section 01330 - For submittal procedures.
- B. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.

1.05 COORDINATION

- A. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers are limited to the following:
 - 1. Bobrick; Basis of Design: www.bobrick.com.
 - 2. Bradley Corporation: www.bradleycorp.com.
 - 3. Stefc Industries: www.stefcoindustries.com.
 - 4. Technical Concepts: www.technicalconcepts.com.
 - 5. Alternate Brand Request or Substitution Request required.

2.02 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 - 1. Grind welded joints smooth.
 - 2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.
- B. Stainless Steel Sheet: ASTM A 666, Type 304.
- C. Stainless Steel Tubing: ASTM A 269, Type 304 or 316.
- D. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A 653/A 653M, with G90/Z275 coating.
- E. Mirror Glass: Float glass, ASTM C 1036 Type I, Class 1, Quality Q2, with silvering, copper coating, and suitable protective organic coating to copper backing in accordance with GSA CID A-A-3002.
- F. Adhesive: Two component epoxy type, waterproof.
- G. Fasteners, Screws, and Bolts: Hot dip galvanized, tamper-proof, security type.
- H. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

- A. Stainless Steel: No. 4 satin brushed finish, unless otherwise noted.
- B. Chrome/Nickel Plating: ASTM B 456, SC 2, satin finish, unless otherwise noted.
- C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.
- D. Back paint components where contact is made with building finishes to prevent electrolysis.

2.04 TOILET ROOM ACCESSORIES

- A. Paper Towel Dispenser: Roll Feed, surface-mounted unit.
 - 1. Product: 92003 Hardwound Roll Dispenser manufactured by Stefc.
- B. Toilet Paper Dispenser: Double roll, surface-mounted unit.
 - 1. Product: 93000 Twin Jumbo Tissue Dispenser manufactured by Stefc.

- C. Soap Dispenser: Liquid soap dispenser, surface-mounted.
 - 1. Product: 450017 TC 800ml manufactured by Technical Concepts.
- D. Mirror: Stainless steel framed, 6 mm thick float glass mirror.
 - 1. Frame: 0.05 inch (1.3 mm) angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; No.4 finish.
 - 2. Backing: Full-mirror sized, minimum 0.03 inch (0.8 mm) galvanized steel sheet and nonabsorptive filler material.
 - 3. Product: B-290 manufactured by Bobrick.
- E. Grab Bar: Stainless steel, 1-1/4 inches (32 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, nonslip grasping surface finish, concealed flange mounting; 1-1/2 inches (38 mm) clearance between wall and inside of grab bar.
 - 1. Length and configuration: As indicated on drawings.
 - 2. Product: B-6806.99 (with peened surface) manufactured by Bobrick.
- E. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
 - 1. Product: B-270 manufactured by Bobrick.

2.05 SHOWER ACCESSORIES

- A. Robe Hook: Heavy-duty stainless steel, double-prong, stainless steel bracket and back plate for concealed attachment, satin finish.
 - 1. Product: B-211 manufactured by Bobrick.
- B. Shower Rod: 1" diameter, 20-gauge satin finish stainless steel shower curtain rod with concealed wall brackets.
- C. Shower Curtain and Hooks: curtain opaque, matte white vinyl, antibacterial and flame-retardant agents. nickel-plated grommets.
 - 1. Product: B-204-1 manufactured by Bobrick.

2.06 UTILITY ROOM ACCESSORIES

- A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch (1.3 mm) thick stainless steel, Type 304, with 1/2 inch (12 mm) returned edges, 0.06 inch (1.6 mm) steel wall brackets.
 - 1. Hooks: 4, 0.06 inch (1.6 mm) stainless steel rag hooks.
 - 2. Mop/broom holders: 3 spring-loaded rubber cam holders.
 - 3. Length: Manufacturer's standard length for number of holders/hooks.
 - 4. Product: B-239x34 manufactured by Bobrick.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.

3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

- A. Install accessories using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
 - 1. Install grab bars to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.
- B. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items. Remove temporary labels and protective coatings.
- C. Mounting Heights and Locations: As required by accessibility regulations and as indicated on drawings A0.3

3.04 SCHEDULE

- A. See drawings.

END OF SECTION

SECTION 11452
APPLIANCES

PART 1 - GENERAL

1.01 CONTRACT CONDITIONS

- A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

1.02 EXTENT OF WORK

- A. Washer/Dryers for Washeteria.

1.03 RELATED WORK

1. Division 12 Casework
2. Division 15 Mechanical
3. Division 16 Electrical

PART 2 – RESIDENTIAL APPLIANCES

2.01 Appliances

1. Range: Drop-In, Electric, 4 Coil Heating Elements, Dual Element Bake, Self Cleaning
2. Refrigerator: Bottom Freezer Door, 20 Cubic Feet.
3. Washer: Front Loading. 4.0 Cubic Feet, Electric, Stainless Steel Basket
4. Dryer: Front Loading, Electric, 6.0 Cubic feet.
5. Range Hood: 2 speed, light

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Appliances: Verify that clearances are adequate for proper functioning.
- B. Provide all required electrical, plumbing, and venting connection accessories for a complete ready to operate installation in compliance with applicable codes.

END OF SECTION

SECTION 12304

CASEWORK

PART 1 – GENERAL

1.01 CONTRACT CONDITIONS

- A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

1.02 EXTENT OF WORK

- A. This section includes Plastic laminate cabinets and countertops.
- B. This section includes wood veneer & glass display cases

1.03 RELATED SECTIONS

Division 15 Sinks and Service Fixtures, Service Wall Lines, connections, and Vents

Division 16 Display case light fixtures

1.04 DEFINITIONS

- A. Identification of casework components and related products by surface visibility.
 - 1. Interiors: Both open and closed interiors finish as for closed interiors.
 - 2. Exposed Surfaces: Faces of doors, end panels, and drawers when closed, exposed surface to receive laminate.

1.05 QUALITY ASSURANCE

- A. Manufacturer: Minimum of 5 years experience in providing manufactured casework systems for similar types of projects produce evidence of financial stability, bonding capacity, and adequate facilities and personnel required to perform on this project.
- B. Manufacturer: Provide certificate of compliance with AWI/WIC Quality Standards
- C. Manufacturer: Provide products meeting AWI and/or WIC Standards.

1.06 SUBMITTALS

- A. Product Data: Manufacturer's catalog with specifications and construction details.
- B. Shop Drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements.
 - 1. Include section drawings of typical and special casework, work surfaces and accessories.
 - 2. Indicate locations of plumbing and electrical service field connection by others.

1.07 CASEWORK SAMPLES

- A. Only required if product is other than those specified.
 - 1. Base cabinet: Cabinet conforming to specifications, with drawer and door.
 - 2. Wall cabinet: Cabinet conforming to specifications, with door.
 - 3. Cabinet samples shall be complete with specified hardware for doors, drawers and shelves.
 - 4. Component samples: Two sets of samples for each of the following:
 - a. Decorative laminate color samples.
 - b. PVC edgings.

1.08 PRODUCT HANDLING

- A. Move stored laminate clad casework, countertops, and related products into bldg only after wet operations in building are completed, store in ventilated place, protected from the weather, with relative humidity range of 20 percent to 50 percent. Material must acclimate to building conditions for minimum period of 7 days.
- B. Protect finished surfaces from soiling and damage during handling and installation.
- C. General Contractor is responsible for protection of installed material.

1.09 JOB CONDITIONS

- A. Conditions: Do not install casework until interior plastering and other wet operations are complete.

1.10 WARRANTY

- B. One year warranty against material defects effective from date of substantial completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers shall comply with the minimum levels of material and detailing indicated on the Drawings or as specified.

2.02 CASEWORK

- A. Core Materials:
 - 1. Particleboard up to 7/8 inch thick: Industrial Grade average 47-pound density particleboard, ANSI A 208.1-1999, M-3.
 - 2. Particleboard 1 inch thick and thicker: Industrial Grade average 45-pound density particleboard, ANSI A 208.1-1999, M-2.
 - 3. MR Moisture Resistant Particleboard: Average 47-pound density particleboard, ANSI A 208.1 1-1999, M-3.

4. Medium Density Fiberboard 1/4 inch thick: Average 54-pound density grade, ANSI A 208.2.
 5. Medium Density Fiberboard 3/4 inch thick: Average 48-pound density grade, ANSI A 208.2.
- B. Door and Drawer Faces
1. Plastic Laminate
- C. Edging Materials:
1. 1mm PVC banding for horizontal cabinet box edges and shelves
 2. 3mm PVC banding, machine profiled to 1/8-inch radius for cabinet door and drawer edges and cabinet box vertical edges
- D. Support Members: Furniture grade, epoxy powder coated steel.
1. Countertop support brackets.
- E. Cabinet Hardware
1. Hinges:
 - a. Five knuckle, institutional grade, 2-3/4 inch overlay type with hospital tip; 0.095 inch thick; ANSI-BHMA standard A156.9, Grade 1.
 - 1) Doors 48 inches and over in height have 3 hinges per door.
 - 2) Magnetic door catch with maximum 7-pound pull provided, attached with screws and slotted for adjustment.
 2. Pulls:
 - a. Door and drawer front pulls, Satin Chrome, Wire style. Wire pulls are positioned Horizontal on drawers and Vertical on doors unless otherwise noted.
 - b. Rooms 105 Resource and 137 Resource only: Door and drawer front pulls, ABS plastic, recess style. Pull design shall comply with the Americans with Disability Act (ADA).
 - c. Retractable Stepping Stools only: Collapsible recessed pulls; satin chrome as indicated on drawings.
 3. Drawer Slides:
 - a. Regular, knee space and pencil: Full Extension, 100-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers. Positive stop both directions with self-closing feature. Paper storage, 150-pound load rated epoxy coated steel slides.
 - b. File: Full extension, 150-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers. Positive stop both directions with self-closing feature.
 4. Adjustable Shelf Supports:

- a. Standard adjustable shelf support system shall be provided by inserting polypropylene plastic double-pin locking shelf clips into predrilled 5 mm diameter holes 32 mm on centers. Color – Clear. Shelves may be fixed using a retaining screw.
 5. Casters: Soft rubber double ball bearings, heavy gauge steel fork, zinc plate finish with 2 brakes per unit. Load capacity per caster to be a minimum of 200 pounds.
- F. Locks:
1. Best 1E7E4, Slabbed Cabinet Mortise Cylinder Lost Motion Cam style lock with removable core; solid brass. Furnish 2 keys. Lock for sliding 3/4-inch thick doors is a disc type plunger lock, sliding door type with strike. Slide bolts used to secure inactive door on all locked cabinets.
- G. End panels
1. Plastic Laminate

2.03 FABRICATION OF CASEWORK AND DISPLAY CASES

- A. Fabricate casework, countertops and related products to dimensions, profiles, and details shown.
- B. Cabinet Body Construction:
1. Tops and Bottoms are glued and doweled to cabinet sides and internal cabinet components such as fixed horizontals, rails, and verticals. Minimum 6 dowels each joint for 24-inch deep cabinets and a minimum of 4 dowels each joint for 12-inch deep cabinets.
 2. Tops, bottoms, and sides of all cabinets are particleboard core.
 3. Exposed back on cabinets: 3/4-inch thick particleboard with the exterior surface finished in VGS laminate as selected.
 4. Flexible rail mounted cabinet backs: 3/4-inch thick particleboard structurally doweled into cabinet sides and top panels.
 5. Fixed base and tall units have an individual factory-applied base, constructed of 3/4-inch thick exterior grade plywood. Base is 96mm (nominal 4 inch) high unless otherwise indicated on the drawings.
 6. Sink base units are provided with open top, a welded steel/epoxy painted sink rail full width at top front edge concealed behind face rail/doors, a split back removable access panel.
 7. Side panels and vertical dividers shall receive adjustable shelf hardware at 32mm line boring centers. Mount door hinges, drawer slides and pullout shelves in the line boring for consistent alignment.
 8. Exposed and semi exposed edges.

- a. Edging: 1mm PVC
 9. Adjustable shelf core: 3/4 inch thick particleboard up to 30 inches wide, 1 inch thick particleboard over 30 inches wide.
 - a. Front edge: 1mm PVC.
 10. Interior finish, units with open Interiors:
 - a. Top, bottom, back, sides, horizontal and vertical members, and adjustable shelving faces with VGS high-pressure decorative laminate.
 11. Interior finish, units with closed Interiors:
 - a. Top, bottom, sides, horizontal and vertical members, and adjustable shelving faces with thermally fused melamine laminate with matching pre-finished back.
 12. Exposed ends:
 - a. Faced with VGS high-pressure decorative laminate.
 13. Wall unit bottom
 - a. Faced with thermally fused melamine laminate.
 14. Balanced construction of all laminated panels is mandatory. Unfinished core stock surfaces, even on concealed surfaces (excluding edges), not permitted.
 15. Continuous Hinge: Stanley SC311, Steel Ga .040inch, 1 1/2" x 48"
- C. Drawers:
1. Sides back and sub front: Minimum 1/2-inch thick particleboard, laminated with thermally fused melamine doweled and glued into sides. Top edge banded with 1mm PVC.
 2. Drawer bottom: Minimum 1/2-inch thick particleboard laminated with thermally fused melamine, screwed directly to the bottom edges of drawer box.
 3. Door/Drawer Fronts:
 - a. 3/4-inch thick particleboard core with VGS High Pressure decorative laminate.
 - b. Door/drawer edges: 3mm PVC, external edges and outside corners machine profiled to 1/8-inch radius. Miscellaneous Shelving:
 - 1) Core material: 3/4 inch or 1 inch thick particleboard.
 - 2) Exterior: VGS High-pressure decorative laminate.
 - 3) Edges: 3mm PVC, external edges and outside corners machine profiled to 1/8-inch radius.

- 4) Edges are machine applied with moisture curing polyurethane (PUR) hot melt for fast setting, high strength adhesion.

2.05 COUNTERTOPS

- A. Acceptable Manufacturers are limited to the following:
 1. Formica Corp: www.formica.com.
 2. Nevamar, International Paper: www.nevamar.com.
 3. Wilsonart International, Inc: www.wilsonart.com.
 4. Alternate Brand Request or Substitution Request required.
- B. High Pressure Decorative Laminate (HPDL):
 1. Decorative Laminate Countertops shall be GP50 NEMA Grade laminate with .020" backing sheet bonding to 3/4" water resistant MDF substrate. Adhesives shall be either Type III PVA or contact cement depending on material size and job conditions. Decorative laminate color selection to be as specified.
 2. Finished edges shall be trimmed with GP50 grade laminate applied before the top surface. Overall thickness to be 1 1/2" with build-up added to the substrate
 3. Backsplashes will be 3/4" thick and 4" high unless otherwise noted. The splashes will be top set and provided with a scribe strip on the top. Material and color to be the same as countertop deck.

PART 3- EXECUTION

3.04 INSPECTION

- A. The casework contractor must examine the job site and the conditions under which the work under this section is to be performed, and notify the building owner in writing of unsatisfactory conditions. Do not proceed with work under this Section until satisfactory conditions have been corrected in a manner acceptable to the installer.

3.04 PREPARATION

- A. Condition casework to average prevailing humidity conditions in installation areas prior to installing.

3.03 INSTALLATION

- B. Erect casework, plumb, level, true and straight with no distortions. Shim as required. Where laminate clad casework abuts other finished work, scribe and cut to accurate fit.
- C. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind.
- D. Repair minor damage per plastic laminate manufacturer's recommendations. Replace other damaged cabinets or materials.

3.04 CLEANING

- A. Leave cabinets broom clean inside and out. Wipe off fingerprints, pencil marks, and surface soil etc., in preparation for final cleaning by the building owner.
- B. Remove and dispose of all packing materials and related construction debris.

END OF SECTION

SECTION 12520
WINDOW SHADES

PART 1 - GENERAL

1.01 CONTRACT CONDITIONS

- A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

1.02 EXTENT OF WORK

- A. Manual window shades and accessories for sun/glare/heat control.

1.03 RELATED WORK

08560 Vinyl Windows

1.04 SUBMITTALS

- A. Product Data: Manufacturer's catalog data, product descriptions, installation instructions, detail sheets, and specifications for each type system specified.
- B. Shop Drawings: Prepared specifically for this project; show dimensions and interface with other products.
 - 1. Room schedule including dimensions of each opening to receive window shade systems.
 - 2. Indicate System Series, operator, fabric selection, and mounting type.

1.05 PRODUCT DELIVERY, STORAGE, & HANDLING

- A. Deliver products to project site in manufacturer's original cartons.
- B. Inspect the materials upon delivery to assure that specified products have been received.
- C. Store and handle shades to prevent damage to fabrics, finishes, and operators prior to installation.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. MechoShade Systems, Inc, 42-03 35th Street, Long Island City, NY 11101, (718) 729-2020; or approved equal.

B. Shade

1. Mech-Shade 5
2. SnapLoc Spline
3. Static Mode
4. SnapLoc Fascia
5. Euro Veil 5300 Series

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install window shade systems in accordance with manufacturer's instructions and these specifications.
- B. Assume responsibility for all field dimensions and mounting surfaces.
- C. Adjust window shade systems for proper operation.

END OF SECTION

SECTION 13851
FIRE ALARM SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Fire alarm and smoke detection control panels.
- B. Initiating devices.
- C. Signaling appliances.
- D. Fire alarm wire and cable.

1.02 RELATED SECTIONS

- A. Division 1 – General Requirements.
- B. Sections 16010 – Basic Electrical Requirements.
- C. Section 16060 – Grounding and Bonding.
- D. Section 16070 – Hangers and Supports.
- E. Section 16075 – Electrical Identification.
- F. Section 16123 – Building Wire and Cable.
- G. Section 16130 – Raceway and Boxes.

1.03 REFERENCES

- A. ADA – Americans with Disabilities Act.
- B. IBC - International Building Code.
- C. National Fire Protection Association:
 - 1. NFPA 70 – National Electrical Code, latest adopted edition.
 - 2. NFPA 72 – National Fire Alarm Code, latest adopted edition.
 - 3. NFPA 101 – Life Safety Code, latest adopted edition.
- D. Underwriters Laboratories, Inc.:
 - 1. UL 467 – Grounding and Bonding Equipment.

1.04 SYSTEM DESCRIPTION

- A. Fire Alarm System: NFPA 72, manual and automatic local fire alarm system.

1.05 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70, latest adopted edition, NFPA 72, NFPA 101 and IBC.

- B. Furnish products listed and classified by Underwriters Laboratories, Inc as suitable for purpose specified and shown.

1.06 QUALIFICATIONS

- A. Manufacturer and Installer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience, and with service facilities within 500 miles of Project.

1.07 QUALITY ASSURANCE

- A. Perform Work in accordance with NECA 1 - Standard Practices for Good workmanship in Electrical Contracting.

1.08 SUBMITTALS

- A. Submit under provisions of Division 1 and Division 16.
- B. Shop Drawings: Provide annunciator layout and system wiring diagram showing each device and wiring connection required.
- C. Product Data: submit manufacturers standard catalog data, include electrical characteristics and connection requirements.
- D. Test Reports: Indicate satisfactory completion of required tests and inspections.
- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of products.

1.09 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1 and Division 16.
- B. Record on the as-built Drawings, the actual locations of panels, annunciators, initiating devices, signaling appliances, and end-of-line devices.

1.10 PROJECT CONDITIONS

- A. Verify locations of panels and devices prior to rough-in.

1.11 DESIGN REQUIREMENTS

- A. Conduit Size: NFPA 70.

1.12 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Division 1 and Division 16.
- B. Accept products on site. Inspect for damage.
- C. Protect products from damage before, during, and after installation until Substantial Completion Inspection approval.

1.13 COORDINATION

- A. Coordinate Work under provisions of Division 1 and Division 16.
- B. Determine and maintain required separation between fire alarm panels and devices and other work.
- C. Coordinate and provide fire alarm panels and device locations to avoid interference with other work.

1.14 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 1 and Division 16.
- B. Operation Data: Operating instructions.
- C. Maintenance Data: Maintenance and repair procedures.

1.15 EXTRA MATERIALS

- A. Furnish under provisions of Division 1 and Division 16.
- B. Provide one each manual pull station.
- C. Provide two each heat detector without base.
- D. Provide two each automatic smoke detector without base.
- E. Provide 4 each replaceable optical chambers.

PART 2 - PRODUCTS

2.01 FIRE ALARM AND SMOKE DETECTION CONTROL PANEL

- A. Manufacturers:
 - 1. Edwards Model FSP 1004
 - 2. Substitutions: Under provisions of Division 1 and Division 16.
- B. Control Panel: Modular construction with surface wall-mounted enclosure.
- C. Power Supply: Adequate to supply control panel modules, remote detectors, remote annunciators, door holders, smoke dampers, relays, and alarm signaling devices. Include battery-operated emergency power supply with capacity for operating system in standby mode for 24 hours followed by alarm mode for 5 minutes.
- D. System Supervision: Component, wiring, or power supply failure places system in trouble mode.
- E. Initiating Device Circuits: Supervised zone module with alarm and trouble indication; occurrence of single ground or open condition places circuit in trouble mode but does not disable that circuit from initiating an alarm.
- F. Indicating Appliance Circuits: Supervised signal module, sufficient for signal devices connected to system; occurrence of single ground or open condition

- places circuit in trouble mode but does not disable that circuit from signaling an alarm.
- G. Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts for each detection zone to provide accessory functions specified.
 - H. Provide TROUBLE ACKNOWLEDGE, DRILL, and ALARM SILENCE switch.
 - I. Trouble Sequence of Operation: System or circuit trouble places system in trouble mode, which causes the following system operations:
 - 1. Visual and audible trouble alarm indicated [by zone] at fire alarm control panel.
 - 2. Manual acknowledge function at fire alarm control panel silences audible trouble alarm; visual alarm is displayed until initiating failure or circuit trouble is cleared.
 - J. Alarm Sequence of Operation: Actuation of initiating device places circuit in alarm mode, which causes the following system operations:
 - 1. Sound and display local fire alarm signaling devices.
 - 2. Indicate location of alarm zone on fire alarm control panel.
 - 3. Transmit signal to building mechanical systems to initiate shutdown of fans and damper operation.
 - K. Alarm Reset: System remains in alarm mode until manually reset with key-accessible reset function. System resets only if initiating circuits are out of alarm mode.
 - L. Lamp Test: Manual lamp test function causes alarm indication at each zone at fire alarm control panel and at annunciator panel, but does not cause alarm or trouble signals to be sounded or transmitted off site.
 - M. Drill Sequence of Operation: Manual drill function causes alarm mode operation as described above.

2.02 INITIATING DEVICES

- A. Manual Pull Station: Semi-Flush, single action. Provide manufacturer's standard backbox.
- B. Spot Heat Detector: Combination rate-of-rise and fixed temperature, rated 135 degrees F.
- C. Duct Mounted Smoke Detector: NFPA 72 photoelectric type with auxiliary SPDT relay contact, key-operated NORMAL-RESET-TEST switch, duct sampling tubes extending width of duct, and visual indication of detector actuation, in duct-mounted housing. Provide two-wire detector with common power supply and signal circuits.

2.03 SIGNALING APPLIANCES

- A. Building System Mini-Combination Horn/Strobe: NFPA 72, semi-recessed, non-projection type fire alarm horn. Sound Rating: 82 dB at 10 feet. Provide integral strobe lamp and flasher with red lettered "FIRE" on white lens. Strobe intensity shall be field adjustable and set based on the approved shop Drawings, and comply with ADA requirements.
- B. Building System Alarm Lights: NFPA 72, strobe lamp and flasher with red lettered "FIRE" on white lens. Strobe intensity shall be field adjustable and set based on the approved shop Drawings and comply with ADA requirements.

2.04 FIRE ALARM WIRE AND CABLE

- A. Fire Alarm Power Branch Circuits: Building wire as specified in Section 16123.
- B. Initiating Device and Indicating Appliance Circuits: Building wire as specified in Section 16123. Power limited fire-protective signaling cable classified for fire and smoke characteristics, copper conductor, 300 volts insulation rated 105 degrees C, suitable for use in air handling ducts, hollow spaces used as ducts, and plenums.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Use 16 or 14 AWG minimum size conductors for fire alarm detection and signal circuit conductors. Install wiring in conduit.
- C. Mount end-of-line device if required "electrically" beyond the last inline device.
- D. Make conduit and wiring connections to duct smoke detectors and all other equipment and systems.
- E. Automatic Detector Installation: Conform to NFPA 72.
- F. Ground and bond system under provisions of Section 16060.
- G. Identify conduit under provisions of Section 16075.

3.02 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 1 and Division 16.
- B. Test in accordance with NFPA 72 requirements.

3.03 FIRE ALARM WIRE AND CABLE COLOR CODE

- A. Provide fire alarm circuit conductors with insulation color-coded as follows, or using colored tape at each conductor termination and in each junction box.
- B. Power Branch Circuit Conductors: Black, red, white.
- C. Initiating Device Circuit: Black, red.

- D. Signal Device Circuit: Blue (positive), white (negative).

3.04 SYSTEM VERIFICATION

- A. Fire alarm equipment supplier shall provide a thorough inspection of the completely installed fire alarm system including all components such as manual stations, thermal detectors, products-of-combustion detectors, sprinkler flow valves and switches, alarm stations, and controls, to insure the following:
 - 1. Complete and functional integral system conforming with requirements of authorities having jurisdiction.
 - 2. Compliance with Underwriters' Laboratories requirements and the provisions and requirements of the NFPA.
 - 3. Installation is in accordance with manufacturer's recommendations and instructions.
 - 4. Adherence to requirements and regulations covering supervision of components.
- B. Provide corrective measures necessary to conform with requirements in items 1 through 4 above in conjunction with technical assistance from the manufacturer.
- C. During the period of this inspection by the manufacturer, supply to the manufacturer one electrician and one apprentice.

3.05 DEMONSTRATION

- A. Provide systems demonstration under provisions of Division 1 and Division 16.
- B. Demonstrate normal and abnormal modes of operation, and required responses to each.

END OF SECTION

SECTION 15010

GENERAL MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Basic Mechanical Requirements specifically applicable to Division 15 as delineated in these specifications, in addition to Division 01 – General Requirements.

1.02 SCOPE

- A. Furnish all labor, materials, equipment, supervision of labor and performance of all operations required to completely install satisfactorily operating mechanical and plumbing systems as defined herein and on Drawings.
- B. Major items of work include, but are not limited to, the installation of the following systems:
 - 1. Plumbing systems.
 - 2. Fuel oil piping system.
 - 3. Heating, ventilation & air conditioning systems.
 - 4. Heat generation systems.
 - 5. Heat transfer systems.
 - 6. Air handling systems.
 - 7. Controls systems.
- C. Other Divisions of these Specifications apply to work generally defined by Division 15 Specifications and/or shown on Mechanical Drawings. For additional details, refer to Drawings detailing work under other Divisions. All work shown on the "M" series Drawings and 15000 series Specifications is to be provided unless otherwise stated.
- D. The drawings and specifications are complementary to each other. What is shown on one is as binding as if called for in both. The mechanical drawings are generally diagrammatic and are intended to show mechanical details in a schematic fashion. Do not scale mechanical drawings. Exact locations are not shown unless so indicated or specifically dimensioned. Typical connection diagrams are schematic and do not show the actual physical arrangement of

equipment. The plans do not necessarily show complete details of all the features that may affect the mechanical installations; however, it is the intent of the contract documents to provide a complete and satisfactorily working installation.

- E. Submit in writing to the Department's Representative for review details of any necessary or proposed departures from these Contract Documents and reasons therefore, as soon as practicable within 30 days after the award of the contract. Make no such departure without prior written approval of the Department's Representative.
- F. Coordination of the Work: Coordinate work under this Division with work of other trades to avoid conflicts, errors, and delays.
- G. Verify the approximate location of equipment and other mechanical system components shown on the Drawings and report any conflicts with openings, structural members, and components of other systems and equipment having fixed locations.
- H. During the course of accomplishing the work defined herein and on the Contract Drawings, the Contractor discovers major damage, defect or deterioration to existing equipment or systems indicated as existing to remain, and where such damage, defect or deterioration will or might effect the safe and proper operation of such equipment and systems, the Contractor shall immediately notify the Department's Representative in writing.

1.03 REFERENCES

- A. Codes and Standards: All work and materials shall comply with the latest issues of the following:
 - 1. Air Moving and Conditioning Association (AMCA).
 - 2. American National Standards Institute (ANSI).
 - 3. Air-Conditioning and Refrigeration Institute (ARI).
 - 4. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE).
 - 5. American Society of Mechanical Engineers (ASME).
 - 6. American Society for Testing Materials (ASTM).
 - 7. American Water Works Association (AWWA).
 - 8. American Welding Society (AWS).

9. Environmental Protection Agency (EPA).
10. Hydraulic Institute (HI).
11. International Building Code (IBC).
12. International Fire Code (IFC).
13. International Mechanical Code (IMC).
14. National Bureau of Standards (NBS).
15. National Environmental Balancing Bureau (NEBB).
16. National Electrical Code (NEC).
17. National Electrical Manufacturers Association (NEMA).
18. National Fire Protection Association (NFPA).
19. Occupational Safety and Health Administration (OSHA).
20. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
21. Underwriters Laboratories, Inc. (UL).
22. Uniform Plumbing Code (UPC).
23. All base materials shall comply with standards of ASTM and ANSI.

1.04 QUALITY ASSURANCE

- A. All work and materials shall be in accordance with applicable codes, standards and ordinances, rules and regulations of the Fire Marshal and of the utility companies. Nothing in the Drawings and Specifications shall be construed as requiring or permitting work in violation of such codes.
- B. Rulings and interpretations of the agencies having jurisdiction shall be considered as part of the codes and regulations if commonly known to the trade prior to bidding.
- C. Whenever the Drawings and Specifications require higher standards than the codes and regulations, the Drawings and Specifications shall govern.
- D. Only craftsmen skilled in their trade shall be employed.
- E. Fan Requirements

1. Performance Ratings: Conform to AMCA 210.
2. Sound Ratings: AMCA 301, tested to AMCA 300.
3. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
4. Balance Quality: Conform to AMCA 204.

1.05 SUBMITTALS

- A. Submit shop drawings, product data, material data sheets, manufacturers' literature, and all other items as specified in Division 01 and the individual sections of Division 15000. Incomplete or partial Division 15000 submittals will be returned without review.
- B. Furnish physical and performance data, including materials, manufacturers' names, model numbers, sizes, capacities, finishes, colors, accessories and other data required to completely describe equipment and to indicate compliance with Drawings and Specifications.
- C. Submit shop drawings of any product that is not the standard catalog product of an established manufacturer and is fabricated by the Contractor.

1.06 CLOSEOUT SUBMITTALS

- A. Submit all required certifications and testing reports as specified in Division 01 and as follows:
 1. Upon completion of instruction, submit a certification that instruction in the maintenance and operation of all mechanical systems and equipment, as specified herein, has been provided to designated personnel.
 2. The certification shall:
 - a. list systems and equipment which were the subject of instruction,
 - b. list the names personnel instructed the dates of instruction,
 - c. list the names of the personnel providing instruction,
 - d. list the appropriate areas of instruction,
 - e. list the dates of classroom and on-site instructional session, and
 - f. be signed by all individuals participating in the instruction (both instructor and instructed).

B. Operating and Maintenance Data:

1. Minimum number and type of copies of the manual are to be provided per Division 1. Locate one hard copy in the mechanical room.
2. Hard cover manuals are to be bound together in D-ring metal-ringed hardcover binders with removable pages, with a typewritten index indicating location of items in the work. Any information not pertinent to this work shall be deleted or neatly and completely lined out. Binders shall be of capacity to allow a minimum of 20 percent expansion.
3. The following components of the mechanical portion of the maintenance manual shall be printed so as not to fade, be permanently framed, glass or plexiglass covered and mounted in a convenient location in the Mechanical Room:
 - a. Valve directory.
 - b. Equipment nameplate directory.
 - c. System schematic drawings.
 - d. Master maintenance schedule.
 - e. Startup, shutdown, and draining instructions.
4. Operation and maintenance information for each piece of equipment is to be provided. For each piece of equipment, note the specific model number and any additional accessories being provided and contact information for where spare parts and service can be obtained. Provide contact information for the Contractor who installed the system.
5. Operational Instructions
 - a. All written instructions are to included in the Operation and Maintenance manual as well as be laminated and posted inside the mechanical room.
 - b. Instructions should include the location and tag information of equipment and valve numbers if appropriate.
 - c. Provide written step-by-step instructions on how to bring the entire facility to fully operational condition from a cold-soaked, stand-by condition. This includes:
 - 1) Verification of fuel storage and method for starting fuel supply system.

- 2) Method for start-up of generator(s).
 - 3) Method for adding heat to the facility including start-up instructions for space heaters.
 - 4) Charging and filling of the domestic water and domestic hot water systems.
 - 5) Operational and adjustment instructions for the air handling unit.
 - 6) Opening outside air intakes for clothes dryer operation.
- d. Provide written step-by-step instructions for putting the facility back into stand-by condition. This includes:
- 1) Draining of domestic water systems including compressed air assisted blow-out of plumbing lines.
 - 2) Filling of plumbing traps with glycol.
 - 3) Closing of opening to the exterior.
6. Operating and maintenance data must be provided for Department's Representative approval at least thirty (30) days prior to Substantial Completion. If approved operation and maintenance instructions are not on hand at the time of Substantial Completion and/or occupancy, the Contractor, at his own expense, shall make all repairs, replacements and installation of any components that may be destroyed or damaged due to the absence of specified instructions, and shall hold the Department harmless.
- C. Submit mechanical HVAC and control system start-up, testing, and demonstration plans.
- D. Submit a mechanical system operating instruction training schedule complete with class outline lesson plan that includes training topics and durations.
- E. Project Record Documents: Record actual locations of piping, ductwork, components and tag numbering.

1.07 PROJECT CONDITIONS

- A. Protection: Protect surrounding areas and surfaces to preclude damage due to the installation of any material or equipment. Unfinished work shall be temporarily protected from unsafe conditions and damage.

- B. Sequencing and Scheduling: Coordinate the scheduling of equipment and material installations with all other affected trades to avoid conflicts. If, during the course of construction, conditions are discovered which adversely affect the mechanical work, immediately notify the Department's Representative before proceeding. Advise other trades of openings required in their work for the subsequent installation of mechanical work or equipment.

1.08 INSPECTION

- A. All work and materials shall be subject at all times to inspection by the Department's Representative and by the agencies having jurisdiction.
- B. Any work or materials found to be damaged or defective or not conforming to the requirements of the Drawings or Specifications, or to the approved finish aesthetic appearance of the job, shall be removed and replaced as directed by the Department's Representative.

1.09 ELECTRICAL REQUIREMENTS

- A. All electrical work, equipment, wiring, devices, and components shall comply with the requirements of local and national electrical codes and with Division 16.
- B. All electrical equipment, devices, and components that are tested by Underwriters Laboratories, Inc. shall be UL listed and shall bear a UL label.
- C. Unless otherwise indicated on the electrical drawings, all mechanical equipment motors and controls shall be furnished, set in place, and wired in accordance with the following schedule. (Carefully coordinate all work with Division 16.) Refer to Division 16 for motor characteristics and motor controls.

	FURNISHED UNDER DIVISION	SET IN PLACE BY DIVISION	LINE VOLTAGE POWER UNDER DIVISION	MECH CONTROL
Equipment Motors	15	15	16	15
Magnetic Motor Starters:				
a. Automatically controlled	16	16	16	15
b. Manually controlled	16	16	16	15
c. In packaged equipment	15	15	16	15
d. Disconnect switches, manual motor starters, thermal overload switches.	16	16	16	15
e. Control relays, transformers, time clocks, thermostats, motor valves, float controls, damper motors, EP and PE switches and other miscellaneous Division 15 controls	15	15	16	15

- D. Where Drawings clearly and explicitly differ from preceding paragraphs, Drawings have precedence.
- E. Factory wired assemblies and panels shall be prewired to numbered terminal strips for connection to field wiring.

1.10 USE OF HEATING SYSTEMS DURING CONSTRUCTION

- A. The Contractor is not allowed to operate the space heaters during construction as construction dust can significantly damage the equipment. Temporary heaters will need to be used.

- B. Operation of the air delivery system during construction shall only be done with specified filters properly installed.
 - 1. When construction is complete, the Contractor shall install new filters at no additional expense to the Department. The Contractor shall pay for all energy used until acceptance of the building.

1.11 GUARANTEE

- A. Neither the final certificate of payment, nor any provision in the Contract Documents, nor partial or entire occupancy of the premises by the Owner shall constitute an acceptance of work not done in accordance with the Contract Documents or relieve the Contractor of liability in respect to any express warranties or responsibilities for faulty materials or workmanship.
- B. The Contractor shall remedy any defects in the work and pay for any damage to other work resulting therefrom which shall appear within a period one year from the date of final acceptance of work, unless a longer period is specified. The Department's Representative will give notice of observed defects with reasonable promptness.

1.12 OPERATING AND MAINTENANCE DATA

- A. The Contractor shall prepare operating and maintenance instructions containing information to operate, prolong service life or replace parts of the work. Operating and maintenance data shall specifically include:
 - 1. List of all contractors' and subcontractors' names, addresses, and telephone numbers.
 - 2. List of all equipment and material manufacturers' local representatives and suppliers and their addresses and telephone numbers.
 - 3. Pipe and duct identification schedules.
 - 4. Nameplate directory with a list of all equipment indicating designation, location of equipment, manufacturers' name, model number, electrical characteristics, primary control switch location and normal position of switch.
 - 5. Valve directory indicating valve number, size, location, function, service, type, and normal position.
 - 6. Air and hydronic test and balance report.

- B. Equipment Literature: For all equipment, fixtures, devices, valves and specialties, provide the following:
1. Manufacturer's data sheets and cut sheets.
 2. Model and serial numbers.
 3. Capacity curves, charts and calculations.
 4. Electrical characteristics.
 5. Replacement parts list.
 6. As-built equipment piping diagrams.
 7. As-built equipment wiring diagrams.
 8. Manufacturer's instructions for operation and maintenance.
 9. Completely mark out on all literature sheets all non-applicable items.
 10. Where piping and wiring diagrams are not available from the manufacturer, they shall be produced by the Contractor.
 11. Literature shall be grouped together by system, i.e., plumbing, heat generation, etc. For each system section, the Contractor shall produce and include a basic system written narrative description. Each narrative shall be comprised of the following:
 - a. Brief system description, including sequence of operation.
 - b. Basic system function discussion, including any interaction with other systems or components.
 - c. Primary system preventive maintenance procedures.
 - d. How to isolate all major components.
 - e. How to drain, fill, and vent liquid system.
 - f. How to drain, clean, and refill all tanks, pumps, and tube bundles.
 - g. How to clean coils and change air filters for air systems.
 - h. Emergency shutdown procedures.

- C. Master Maintenance Schedule: List each item of equipment requiring inspection and maintenance, showing component maintenance required and the intervals when such inspection and maintenance shall be performed (daily, weekly, monthly, semi-annually, etc.). For each item, reference the page within the maintenance manual where detailed manufacturer's maintenance instructions can be found.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment shall be those of major and reputable manufacturers with ability to render competent and thorough service through local organizations and expeditiously to provide spare parts.
- B. In addition to material and equipment specified, also provide incidental materials required to effect complete installation. Such incidental materials include solders, tapes, caulking, mastics, gaskets, etc.
- C. Mixes, Compounds, Dopes, Tapes and Fluxes: All mixes, compounds, dopes, tapes and fluxes shall be fresh, highest quality, free of contaminants, of the type and grade suitable for the intended use in each case. Where more than one type of mix, etc. is specified for the same service, select one type; however, state which type is proposed for use in the submittal material and in no case more than one type is to be used in a specific mechanical system. Where two or more units of the same mix, etc., are required, provide products of a single manufacturer. Provide mixes, etc., bearing approval stamps wherever standards have been established. Comply with governing regulations and industry standards for selections, and with manufacturers' recommendations where applicable.
- D. Valves, piping specialties, and escutcheons and access panels to be of same manufacturer throughout installation even though they may be specified in different Divisions of these specifications.
- E. All materials and equipment shall be free of asbestos. Mixes, fluxes, and solders shall be free of lead. Submit certification no asbestos or lead based materials have been used or installed.
- F. Provide all special tools and extra materials required for maintenance of installed equipment as follows:
 - 1. Supply two 12 ounce containers of packing lubricant and cartridge style grease gun such as controls system tools and grease guns.
 - 2. Furnish two sets of belts for each fan.
 - 3. Furnish one additional electric motor for the air handling unit.

2.02 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. All materials shall be new, unused, and delivered to the job site packed in their original containers.
- B. All materials shall be delivered free of damage or defects.
- C. Provide adequate storage facilities at the job site to protect materials from damage or corrosion.
- D. Protect material, equipment, and apparatus provided under this Division from damage, water, dust, etc., both in storage and installed until final completion has been filed. Materials, equipment, or apparatus damaged because of improper storage or protection will be rejected and must be removed from site.
- E. Piping, ductwork and all similar equipment shall be capped or protected during storage and installation to protect from construction debris and dust contamination.

PART 3 - EXECUTION

3.01 PREPARATION

- A. The Contractor shall lay out all work in advance of construction and shall determine the correct location and placement of all material and equipment.
- B. Schedule all work in coordination with that of other trades in order to avoid delays in construction and unnecessary cutting and patching.

3.02 INSTALLATION

- A. All work shall be installed neatly and in accordance with the best practices in the trade.
- B. Workmanship must be of highest quality, done by persons especially skilled at assigned tasks, resulting in neat, clean, and well-done installations consistent with best practices of trades.
- C. Repair or replace materials and parts of premises that become damaged as a result of installation of work of this Division. Remove replaced parts from the premises.
- D. Insure installation is performed per the manufacturer's instructions.

3.03 OPERATING AND MAINTENANCE INSTRUCTION

- A. Mechanical Instruction: The Contractor shall provide a minimum of 80 hours of instruction on the operation and maintenance of all mechanical systems to maintenance personnel.
- B. Instruction shall be performed by a qualified technician.
- C. The instruction shall consist of both a “classroom” period and a “field” period.
- D. The classroom portion shall consist of a brief discussion of each piece of equipment, using the maintenance manual as a guide, and a general preventive maintenance discussion of system as a whole; e.g., discuss procedure for maintaining proper glycol heat transfer solution mixture, etc.
- E. The field portion shall consist of a building walk-through to physically locate and examine each piece of equipment previously discussed. At that time, the main points discussed during the classroom portion shall be recovered while pointing out the specific grease fitting or valve, etc.
- F. Certification: The Contractor shall submit, prior to or at the time of Substantial Completion and before the Owner will accept responsibility for maintenance and operation of the facility, certification that instructions of maintenance and operation procedures have been given to the Department’s Representative responsible for the maintenance and operation of the facility.
 - 1. The certification shall indicate the name and be affixed with the signature(s) of the person(s) receiving the instructions, the dates of instruction, the names of the Contractor or subcontractor giving the instructions, and shall list the appropriate areas of instruction. Until these requirements are met, the Contractor shall provide at least one maintenance mechanic, acceptable to the Department’s Representative, to operate and maintain the facility’s system(s).

3.04 START-UP / DEMONSTRATION (as specified in Division 01):

- A. Prepare and submit complete start-up testing and demonstration plans 30 days prior to schedule test, start-up, or demonstration date. All mechanical systems shall be demonstrated for proper operation. The demonstration plan shall clearly identify each system and piece of equipment and the proposed demonstration.
- B. Following successful testing and start-up, submit certifications that the equipment and/or systems are operating properly.

END OF SECTION

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SECTION 15060

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Pipe hangers and supports.
- B. Hanger rods.
- C. Sleeves.
- D. Formed steel channel.
- E. Firestopping relating to mechanical work.
- F. Firestopping accessories.

1.02 REFERENCES

- A. American Society of Mechanical Engineers:
 - 1. ASME B31.1 - Power Piping.
 - 2. ASME B31.9 - Building Services Piping.
- B. ASTM International:
 - 1. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
 - 2. ASTM E119 - Method for Fire Tests of Building Construction and Materials.
 - 3. ASTM E814 - Test Method of Fire Tests of Through Penetration Firestops.
- C. Underwriters Laboratories Inc.:
 - 1. UL 1479 - Fire Tests of Through-Penetration Firestops.
 - 2. UL - Fire Resistance Directory.

1.03 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.

1.04 SYSTEM DESCRIPTION

- A. Firestopping Materials: ASTM E119 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.

1.05 SUBMITTALS

- A. Division 1 - Submittal Procedures: Submittal procedures.
- B. Product Data:
 - 1. Hangers and Supports: Provide list of system and associated hangers and supports to be used on that system. Do not submit the devices.
 - 2. Have available in the Contractor's work shack catalog data for each type of hanger and support used on the project including load capacity and special procedures and assembly of components. Have available for field review. Do not submit through the formal submittal process.
 - 3. Submit product data on any item that is not listed in this specification or the performance does match that requested.
 - 4. Firestopping: Submit data on product characteristics, performance and limitation criteria.

1.06 QUALITY ASSURANCE

- A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as required, but not less than 1-hour.
- B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.

1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.
- C. Perform Work in accordance with applicable authority for welding hanger and support attachments to building structure.
- D. Perform Work in accordance with Municipality of Anchorage standard.

1.07 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.

PART 2 - PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

- A. Waste and Vent Piping:
 1. Conform to ASME B31.9.
 2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or 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.
 6. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
 7. Vertical Support: Steel riser clamp.
 8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 9. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring or all copper construction.

- B. Water and Fuel Oil Piping:
1. Conform to ASME B31.9.
 2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or Carbon steel, adjustable swivel, split ring.
 3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
 4. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
 5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 6. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
 7. Vertical Support: Steel riser clamp.
 8. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 9. Floor Support for Hot Pipe Sizes 4 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 10. Copper Pipe Support: Copper-plated, Carbon-steel ring or all copper construction.
 11. Soft Copper Tubing: Copper-plated hold down clamp, screwed on both sides of clamp.

2.02 ACCESSORIES

- A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.03 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.
- B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- C. Sleeves for Round Ductwork: Galvanized steel.
- D. Sleeves for Rectangular Ductwork: Galvanized steel.

2.04 FORMED STEEL CHANNEL

- A. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.05 FIRESTOPPING

- A. 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 or Multiple component silicone elastomeric compound and compatible silicone sealant.
 2. Foam Firestopping Compounds: Single or Multiple component foam compound.
 3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
 4. Fiber Stuffing and Sealant Firestopping: Composite of mineral or ceramic 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.

2.06 FIRESTOPPING ACCESSORIES

- A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.
- B. Dam Material: Permanent:
1. Mineral fiberboard.
 2. Mineral fiber matting.
 3. Sheet metal.

- 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 UL 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 piping is exposed.
 - 2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

PART 3 - EXECUTION

3.01 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 to arrest liquid material leakage.
- D. Do not drill or cut structural members.

3.02 INSTALLATION - PIPE HANGERS AND SUPPORTS

- A. Install in accordance with ASME B31.1.
- B. Support horizontal piping as scheduled.
- C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.
- D. Provide insulation inserts and shields in accordance with Section 15080.
- E. Place hangers within 12 inches of each horizontal elbow.
- F. Use hangers with 1-1/2 inch minimum vertical adjustment.

- G. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- H. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- I. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
- J. Support riser piping independently of connected horizontal piping.
- K. Provide copper plated hangers and supports for copper piping.
- L. Design hangers for pipe movement without disengagement of supported pipe.
- M. Provide clearance in hangers and from structure and other equipment for installation of insulation.

3.03 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

- A. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
- B. Provide rigid anchors for pipes after vibration isolation components are installed.

3.04 INSTALLATION - SLEEVES

- A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- B. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.
- C. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with firestopping insulation and caulk. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- D. Install chrome plated steel escutcheons at finished surfaces.

3.05 INSTALLATION - FIRESTOPPING

- A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, and other items, requiring firestopping.

3.06 CLEANING

- A. Division 1 - Execution Requirements: Requirements for cleaning.
- B. Clean adjacent surfaces of firestopping materials.

3.07 SCHEDULES

PLUMBING PIPE HANGER SPACING		
PIPE MATERIAL	MAXIMUM HANGER SPACING Feet	HANGER ROD DIAMETER Inches
Cast Iron (All Sizes)	5	5/8
Cast Iron (All Sizes) with 10 foot length of pipe	10	5/8
Copper Tube, 1-1/4 inches and smaller	6	1/2
Copper Tube, 1-1/2 inches and larger	10	1/2
Soft Copper Tube	3	N/A
Steel, 3 inches and smaller	12	1/2
Steel, 4 inches and larger	12	5/8
CPVC, 1 inch and smaller	3	3/8
CPVC, 1-1/4 inch to 3 inch	4	1/2
PEX	3	3/8

END OF SECTION

SECTION 15075

MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe markers.
- D. Labels.

1.02 REFERENCES

- A. American Society of Mechanical Engineers:
 - 1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.03 SUBMITTALS

- A. Division 1 - Submittal Procedures: Submittal procedures.
- 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 valve chart and schedule.

1.04 QUALITY ASSURANCE

- A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.05 QUALIFICATIONS

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

PART 2 - PRODUCTS

2.01 NAMEPLATES

- A. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color. Minimum 1/2 inch text.

2.02 TAGS

- A. Plastic Tags:
 - 1. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter.
- B. Metal Tags:
 - 1. Brass with stamped letters; tag size minimum 1-1/2 inches finished edges.
- C. Information Tags:
 - 1. Black 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.
- D. Tag Chart: Typewritten letter size list of applied tags and locations.

2.03 PIPE MARKERS

- A. Color and Lettering: Conform to ASME A13.1.
- B. Plastic Pipe Markers:
 - 1. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.
- C. Plastic Tape Pipe Markers:
 - 1. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- D. Information: Indicate system, supply or return as applicable, and flow direction.

2.04 LABELS

- A. Description: Aluminum, size 1.9 x 0.75 inches, rivet or adhesive backed with printed identification.

2.05 STARTUP AND SHUTDOWN PLACARDS

- A. Description: Aluminum or other durable material with minimum 1/4 inch high permanent letters. Riveted or screwed to wall adjacent to equipment it describes. Provide detailed, laminated as built drawings of mechanical systems showing where all valves and equipment are located in the facility, securely fasten to a

wall in the mechanical room. Use unique numbering tag scheme to locate equipment on as built drawings and provide corresponding equipment or valve tag at equipment. Where necessary for complete understanding of operation provide diagrams or schematics indicating processes and procedures. Order the startup and shutdown instructions in the order that they must be performed in for proper equipment operation.

1. Provide the following startup and shutdown procedures:
 - a. Generator and fuel oil procedures.
 - b. Domestic water system procedures including well pump, pressure pump, water heater and hot water circulation pump.
 - c. Space heater procedures including adjustment of temperature setpoints.
 - d. Ventilation system procedures including adjustment of the outside/return air dampers, energizing of the equipment and adjustment of the supply air temperature setpoint. Include instructions for fully closing the outside air damper when the facility is shutdown.
 - e. Complete draining of domestic water system and all associated equipment with all low point drains and high point vents clearly identified on as built drawing and physically tagged. Also indicate any equipment that must be removed or modified for complete system drainage.
 - f. Preparing the sanitary sewer system for cold soaking. P-traps, washing machines and any equipment that cannot be fully drained shall be filled with recreational vehicle antifreeze suitable for freeze protection to -50 degrees Fahrenheit.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

- A. Install identifying devices after completion of coverings and painting.
- B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- C. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

- D. Install tags using corrosion resistant chain. Use prefix to designate systems as noted on following schedules. Indicate on tag whether valve is normally open or normally closed (NO or NC). Number tags consecutively by location.
- E. Identify air handling units, pumps, heat transfer equipment and tanks with plastic nameplates. Identify in-line pumps and other small devices with tags.
- F. Identify control panels and major control components outside panels with plastic nameplates.
- G. Identify valves in main and branch piping with tags.
- H. Identify air terminal units and terminal unit valves with numbered tags.
- I. Tag automatic controls, instruments, and relays. Key to control schematic.
- J. Identify piping, concealed and exposed, with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service and flow direction. 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.

3.03 SCHEDULES

IDENTIFICATION

Common abbreviations are shown; submit proposed abbreviations for other systems as needed.

CW	Cold Water
HW	Hot Water
HWC	Hot Water Circulation
TP	Trap Primer (water)
W	Waste
V	Vent
FOS	Fuel Oil Supply
FOR	Fuel Oil Return

END OF SECTION

SECTION 15080
MECHANICAL INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Ductwork insulation.
- B. Duct liner.
- C. Insulation jackets.
- D. Equipment insulation
- E. Piping system insulation.
- F. Inserts and shields.
- G. Insulation accessories including vapor retarders, jackets, and accessories.

1.02 RELATED SECTIONS

- A. Division 9 - Painting

1.03 REFERENCES

- A. American Society for Testing and Materials:
 - 1. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 2. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
 - 3. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - 4. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - 5. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.

6. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
7. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
8. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
9. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
10. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
11. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
12. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.

1.04 SUBMITTALS

- A. Division 1 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.

PART 2 - PRODUCTS

2.01 GLASS FIBER PIPE INSULATION

- A. Manufacturers:
 1. Johns Manville, Micro-Lok, AP-T Plus.
 2. Knauf, 1000° Pipe Insulation.
 3. Owens Corning, Fiberglas Pipe Insulation
- B. Insulation: ASTM C547 Mineral Fiber Pipe Insulation, Type I,
 1. Operating Temperature: 850 degrees F
 2. 'K' factor: 0.24 at 100 degrees F.

- C. Vapor Retarder Jacket:
 - 1. ASJ/SSL conforming to ASTM C 1136 Type I, secured with self-sealing longitudinal laps and butt strips
 - 2. Moisture vapor transmission: ASTM E96; 0.02 perm-inches.
- D. Vapor Retarder Lap Adhesive: Provide product that is compatible with insulation.
- E. Insulating Cement/Mastic: Provide product that is compatible with insulation. ASTM C195; hydraulic setting on mineral wool.
- F. Glass Fiber Fabric:
 - 1. Cloth: Untreated, 9 ounce/square yard weight.
 - 2. Blanket: 1.0 pound/cubic foot density.
 - 3. Weave: 5 x 5.

2.02 ELASTOMERIC CELLULAR FOAM

- A. Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular form: ASTM C534; Type I, Tubular form
- B. Elastomeric Foam Adhesive:
 - 1. Air dried, contact adhesive, compatible with insulation.

2.03 FLEXIBLE GLASS FIBER DUCT AND EQUIPMENT INSULATION

- A. Manufacturers:
 - 1. Johns Manville, Microlite.
 - 2. Knauf, Duct Wrap.
 - 3. Owens Corning, Fiberglas All-Service Duct Wrap.
- B. Insulation: In conformance with ASTM C 553 Types I, II and III, and ASTM C 1290.
 - 1. Operating Temperatures: 250 degrees F.
 - 2. Density: 1.5 pound/cubic foot.
 - 3. 'K' factor: ASTM C518, 0.24 at 75 degrees F.

- C. Vapor Retarder Jacket:
 - 1. PVC conforming to ASTM 1136, Type I or FSK conforming to ASTM 1136, Type II Flexible and Low Permeance Vapor Retarders for Thermal Insulation.
 - 2. Secured in place using outward cinching staples in combination with appropriate pressure-sensitive aluminum foil tape, or in combination with glass fabric and vapor retarder mastic.
 - 3. For systems operating at temperatures below ambient, close and secure seams and joints. When outward clinching staples are used, seal penetrations.
- D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- E. Vapor Retarder Lap Adhesive: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive. Compatible with insulation.
- F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool. Compatible with insulation.

2.04 RIGID GLASS FIBER DUCT AND EQUIPMENT INSULATION

- A. Manufacturers:
 - 1. Johns Manville, 800 Series Spin-Glas.
 - 2. Knauf, Insulation Board
 - 3. Owens Corning Fiberglas® 700 Series Rigid Insulation
- B. Insulation: ASTM C612 Mineral Fiber Block and Board Insulation, Type IA and IB.
 - 1. Temperature rating: 250 degrees F.
 - 2. Density: 3 pound/cubic foot.
 - 3. 'K' factor: ASTM C518, 0.24 at 75 degrees F.
- C. Vapor Retarder Jacket:
 - 1. Foil-Scrim-Kraft (FSK) paper with glass fiber yarn and bonded to aluminized film.

2. Moisture vapor transmission: ASTM E96; 0.02 perm.
 3. Secure with pressure sensitive tape.
- D. Vapor Retarder Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- E. Indoor Vapor Retarder Finish:
1. Cloth: Untreated; 9 oz/sq yd weight, glass fabric.
 2. Vinyl emulsion type acrylic, compatible with insulation.

2.05 GLASS FIBER DUCT LINER, FLEXIBLE

- A. Insulation: ASTM C1071 Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material), Type I
- B. Adhesive:
1. Waterproof, ASTM E162 fire-retardant type.
- C. Liner Fasteners: Galvanized steel, self-adhesive pad or impact applied with integral head.

2.06 GLASS FIBER ROUND DUCT LINER

- A. Product Description: Round, preformed in cylindrical sections with polyvinyl acetate polymer impregnated surface coat.
1. 'K' factor: ASTM C1071, 0.23 at 75 degrees F.
 2. Maximum service temperature: 250 degrees F.
 3. Maximum Velocity on Coated Air Side: 4,000 fpm.

2.07 FIELD APPLIED JACKETS AND ACCESSORIES

- A. PVC Plastic Pipe Jacket:
1. Product Description: ASTM D1784, One piece molded type fitting covers and sheet material, off-white color.
 2. Thickness: 10 mil.
 3. Connections: Brush on welding adhesive.

- B. Covering Adhesive Mastic:
 - 1. Water proof, fire retardant, and compatible with insulation.
- C. Lagging Adhesive:
 - 1. Compatible with insulation.
- D. Impale Anchors:
 - 1. Galvanized steel, 12 gauge, welded.
- E. Aluminum Jacket:
 - 1. ASTM B209.
 - 2. Thickness: 0.016 inch thick sheet.
 - 3. Finish: Embossed.
 - 4. Joining: Longitudinal slip joints and 2 inch laps.
 - 5. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
 - 6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.
- H. Shields
 - 1. Minimum 20 gage galvanized steel or aluminum, rolled.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Division 1 - Administrative Requirements: Coordination and project conditions.
- B. Verify piping, equipment and ductwork has been tested before applying insulation materials.
- C. Verify surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Exposed Piping: Locate insulation and cover seams in least visible locations.
- B. Insulate fittings, valves, and flanges to the same thickness as the pipe insulation.

- C. Man made mineral 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. Continuous Insulation:
1. Insulation shall be continuous at all hangers, supports, penetrations and clamps.
 2. Vapor barrier shall also be continuous through penetration and through transitions between pipe insulation and inserts.
- F. Inserts and Shields:
1. Application: All piping 1-1/2 inches diameter or larger.
 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts. Shields shall extend a minimum of 6 inches beyond hanger in both directions.
 3. Insert location: Between support shield and piping and under finish jacket.
 4. Insert configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
 5. Insert material: Calcium silicate.

- G. 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.
- H. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with aluminum jacket or canvas.
- I. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size insulation large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water.
- J. Insulated ductwork conveying air below ambient temperature:
 - 1. Provide insulation with vapor retarder jackets.
 - 2. Finish with tape and vapor retarder jacket.
 - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 - 4. Insulate entire system including fittings, joints, flanges, and dampers.
- K. Ductwork Exposed in Mechanical Equipment Rooms and Finished Spaces (below 10 feet above finished floor): Finish with canvas jacket finish painted.
- L. Duct and Plenum Liner Application:
 - 1. Adhere insulation with adhesive for 100 percent coverage.
 - 2. Secure insulation with mechanical liner fasteners. SMACNA Standards for spacing.
 - 3. Seal and smooth joints. Seal and coat transverse joints.
 - 4. Seal liner surface penetrations with adhesive.
 - 5. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

3.03 SCHEDULES

A. Piping Glass Fiber Insulation Schedule:

<u>PIPING SYSTEMS</u>	<u>PIPE SIZE</u>	<u>THICKNESS</u>
	<u>Inch</u>	<u>Inch</u>
<u>Plumbing Systems:</u>		
Domestic Water (HW, HWC, CW, TP):	All	1
Plumbing Vents within 10 Feet of the Exterior:	All	2
PEX tubing – elastomeric cellular foam	All	1

B. Coordinate heat trace requirements with Division 16.

C. Ducts

1. All return air duct inside mechanical room to have sound liner.
 - a. Duct and plenum liner: 1 inch thick.
2. All ducts in the mechanical room and below the floor to have exterior insulation.
 - a. Glass Fiber Ductwork Insulation: Minimum 1 inch thick.
3. Dryer make-up air ducts to have continuous insulation with vapor barrier.
 - a. Glass Fiber Ductwork Insulation: Minimum 4 inch thick.

4. Exhaust or relief ducts within 10 feet of exterior openings or backdraft damper, whichever is greater.
 - a. Glass Fiber Ductwork Insulation: 2 inches thick.
5. Outside Air Intake Ducts
 - a. Glass Fiber Ductwork Insulation: 3 inches thick.
6. Relief Ducts within 10 feet of exterior openings
 - a. Glass Fiber Ductwork Insulation: 2 inches thick.

END OF SECTION

SECTION 15110

VALVES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 DEFINITIONS

- A. The following are standard abbreviations for valves:
 - 1. CWP: Cold working pressure.
 - 2. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 3. NBR: Acrylonitrile-butadiene rubber.
 - 4. PTFE: Polytetrafluoroethylene plastic.
 - 5. TFE: Tetrafluoroethylene plastic.

1.03 SUBMITTALS

- A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; and dimensions. Include list indicating valve and its application.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.01 BALL VALVES

- A. 2 inches and Smaller: MSS SP 110, Class 150, bronze, two piece body, chrome plated bronze ball, regular port, teflon seats, blow-out proof stem, solder or threaded ends, lever handle.
- B. 2-1/2 inches and Larger: Cast steel, two piece body, full port chrome plated steel ball, teflon seat and stuffing box seals, lever handle, flanged. (Addendum 4)

2.02 CHECK VALVES

- A. Horizontal Swing Check Valves:
 - 1. 2 inches and Smaller: MSS SP 80, Class 150, bronze body and cap, bronze seat, Buna-N disc, solder or threaded ends.
- B. Spring Loaded Check Valves:
 - 1. 2 inches and Smaller: MSS SP 80, Class 250, bronze body, in-line spring lift check, silent closing, Buna-N disc, integral seat, solder or threaded ends.

2.03 FLOW CONTROL VALVE

- A. Construction: Brass or bronze body with union on inlet temperature and pressure test plug on inlet and outlet.
- B. Calibration: Control within 5 percent of design flow over entire operating pressure. Maximum flow to be designed around 2 psig differential pressure across terminal device.
- C. Control Mechanism: Stainless steel or nickel plated brass piston or regulator cup, operating against stainless steel helical or wave formed spring.
- D. Accessories: In-line strainer on inlet and ball valve on outlet.

2.04 BALANCE VALVES

- A. Bronze body, brass ball construction (sizes over 2-1/2 inches shall be cast iron or ductile iron) with glass and carbon filled TFE seat rings. Valves to have differential pressure readout ports across valve seat area. Readout ports shall be fitted with internal EPT insert and check valve. Valve bodies to have NPT tapped drain/purge port. Valves to have memory stop feature, calibrated nameplate, and shall be leak tight at full rated pressure.

PART 3 - EXECUTION

3.01 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 ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.
- D. Install 3/4 inch ball valves with cap for air vents at exposed, high points in the system for system draining.
- E. Install valves with clearance for installation of insulation and allowing access.
- F. Provide access where valves and fittings are not accessible.

3.02 VALVE APPLICATIONS

- A. Ball valves to be provided for shut-off, and to isolate equipment, part of systems, or vertical risers.
- B. Install spring loaded check valves when the check valve flow is in the downward direction.

3.03 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. Do not attempt to repair defective valves; replace with new valves.

3.04 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION

SECTION 15120
PIPING SPECIALTIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Pressure gages.
- B. Pressure gage taps.
- C. Thermometers.
- D. Thermometer supports.
- E. Static pressure gages.
- F. Flexible connectors.
- G. Air vents.
- H. Strainers.

1.02 RELATED SECTIONS

- A. American Society of Mechanical Engineers:
 - 1. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.
 - 2. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.
- B. ASTM International:
 - 1. ASTM E1 - Standard Specification for ASTM Thermometers.
 - 2. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.

1.03 SUBMITTALS

- A. Division 1 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit for manufactured products and assemblies used in this Project.
 - 1. Manufacturer's data indicating use, operating range, total range, accuracy, and location for manufactured components.

2. Submit product description, model, dimensions, materials, component sizes, rough-in requirements, service sizes, and finishes. Clearly indicate all options and accessories being provided.
3. Submit electrical characteristics and connection requirements.
4. Indicate in writing if an item is not being provided on the project and therefore not submitted.

1.04 CLOSEOUT SUBMITTALS

- A. Division 1 - Execution Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit instructions for calibrating instruments, installation instructions, assembly views, servicing requirements, lubrication instruction, and replacement parts list.

1.05 QUALIFICATIONS

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

PART 2 - PRODUCTS

2.01 PRESSURE GAGES

- A. Gage: ASME B40.1, with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.
 1. Case: Steel
 2. Bourdon Tube: Brass.
 3. Dial Size: 2-1/2 inch diameter.
 4. Mid-Scale Accuracy: One percent.
 5. Scale: Both psi and kP.

2.02 PRESSURE GAGE TAPS

- A. Needle Valve: Brass, 1/4 inch NPT for minimum 300 psi.
- B. Ball Valve: Brass, 1/8 inch NPT for 250 psi.
- C. Pulsation Damper: Pressure snubber, brass with 1/4 inch NPT connections.

2.03 STEM TYPE THERMOMETERS

- A. Thermometer: ASTM E1, lens front tube, cast aluminum case with enamel finish.
 - 1. Fluid: Non-mercury, color blue.
 - 2. Size: 9 inch scale.
 - 3. Window: Clear Lexan.
 - 4. Stem: Brass, 3/4 inch NPT, 3-1/2 inch long.
 - 5. Accuracy: ASTM E77 2 percent.
 - 6. Calibration: degrees F

2.04 DIAL THERMOMETERS

- A. Thermometer: ASTM E1, stainless steel case, bimetallic helix actuated with silicone fluid damping, white with black markings and black pointer hermetically sealed lens, stainless steel stem.
 - 1. Size: 2-1/2 inch diameter dial.
 - 2. Lens: Clear Lexan.
 - 3. Accuracy: 1 percent.
 - 4. Calibration: degrees F

2.05 THERMOMETER SUPPORTS

- A. Socket: Brass separable sockets for thermometer stems with or without extensions.
- B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.06 STATIC PRESSURE GAGES

- A. Dial Gages: 3-1/2 inch diameter dial in metal case, diaphragm actuated, black figures on white background, front calibration adjustment, 2 percent of full scale accuracy.
- B. Inclined Manometer: Plastic with red liquid on white background with black figures, front calibration adjustment, 3 percent of full scale accuracy.

- C. Accessories: Static pressure taps with compression fittings for bulkhead mounting, 1/4 inch diameter tubing.

2.07 FLEXIBLE CONNECTORS

- A. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure.

2.08 AIR VENTS

- A. Manual Type: Disk type vent with built-in check valve for manual or automatic operation, discs replaceable without draining system, 1/8 inch shank, rated at 50 PSI.
- B. Float Type:
 - 1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
- C. Automatic Air Vent: Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

2.09 STRAINERS

- A. Size 2 inch and Smaller:
 - 1. Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

PART 3 - EXECUTION

3.01 INSTALLATION - THERMOMETERS AND GAGES

- A. Install gage taps in piping.
- B. Install pressure gages with pulsation dampers. Provide needle valve or ball valve to isolate each gage.
- C. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.
- D. Install thermometers in air duct systems on flanges.

- E. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets.
- F. Coil and conceal excess capillary on remote element instruments.
- G. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- H. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- I. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.02 INSTALLATION - HYDRONIC PIPING SPECIALTIES

- A. Where large air quantities accumulate, provide enlarged air collection standpipes.
- B. Install manual air vents at system high points.

END OF SECTION

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SECTION 15140

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes domestic water piping inside the building.

1.03 DEFINITIONS

- A. PEX: Crosslinked polyethylene plastic.

1.04 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Water Samples: Specified in Part 3 "Cleaning" Article.
- C. Field quality-control test reports.

1.05 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping System Components and Related Materials," for plastic, potable domestic water piping and components.
- C. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

- A. Refer to Part 3 "Pipe and Fitting Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

- C. Domestic cold, hot, and hot water circulation main distribution piping shall be type K or L copper water tube with soldered joints.
- D. Branch piping to individual fixtures shall generally be Type K or Type L copper or may be PEX water piping with metal insert, crimp-type fittings where complete removal of water for winterization may be problematic. Water piping for the individual shower valves is an example where PEX piping may be used to prevent freeze damage to the water piping to the fixture.

2.02 COPPER TUBE AND FITTINGS

- A. Soft Copper Tube: ASTM B 88, Types K and L, water tube, annealed temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
 - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- B. Hard Copper Tube: ASTM B 88, Types L and M, water tube, drawn temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought- copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
 - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.03 PEX PIPE AND FITTINGS

- A. PEX Distribution System: ASTM F 877, SDR 9 tubing.
 - 1. Fittings for PEX Tube: ASTM F 1807, metal-insert type with copper crimp rings and matching PEX tube dimensions. Female threaded plastic adapters are prohibited.

2. Manifold: Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASTM F 877 and with plastic or corrosion-resistant-metal valve for each outlet.

PART 3 - EXECUTION

3.01 PIPE AND FITTING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground piping, unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Mechanical joints may not be used on copper piping.

3.02 PIPING INSTALLATION

- A. All piping is to be sloped to drain for seasonal cold-soaking. Combine piping into common mains to minimize drain points. Provide wall access panels at all low-point drains valves for ready access.
- B. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Pressure gages are specified in Division 15 Section "Meters and Gages," and drain valves and strainers are specified in Division 15 Section "Plumbing Specialties."

3.03 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- C. PEX tubing shall utilize joints and fittings approved by the piping manufacturer. Install per manufacturer's instructions. Female threaded plastic adapters are prohibited.

3.04 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

3.05 FIELD QUALITY CONTROL

- A. Inspect domestic water piping as follows:
 - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by Owner's Representative.
- B. Test domestic water piping as follows:
 - 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
 - 6. Prepare reports for tests and required corrective action.

3.06 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.

2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION

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SECTION 15150

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Sanitary sewer and vent piping above grade.

1.02 REFERENCES

A. American National Standards Institute:

1. ANSI B16.32 - Cast Copper Alloy Solder Joint Fittings for Solvent Drainage Systems.

B. American Society of Mechanical Engineers:

1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
2. ASME B16.3 - Malleable Iron Threaded Fittings.
3. ASME B16.4 - Gray Iron Threaded Fittings.
4. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings (DWV).
5. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
6. ASME B31.9 - Building Services Piping.

C. American Society for Testing and Materials:

1. ASTM A47 - Standard Specification for Ferritic Malleable Iron Castings.
2. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
4. ASTM B32 - Standard Specification for Solder Metal.
5. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.

6. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes.
 7. ASTM B75 - Standard Specification for Seamless Copper Tube.
 8. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
 9. ASTM B251 - Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
 10. ASTM B302 - Standard Specification for Threadless Copper Pipe.
 11. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV).
 12. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
 13. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
 14. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
- D. Cast Iron Soil Pipe Institute:
1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
 2. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
- E. 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 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
 4. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
 5. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
 6. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
 7. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

F. Plumbing and Drainage Institute:

1. PDI G101 - Standard - Testing and Rating Procedure for Grease Interceptors.

1.03 SUBMITTALS

A. Product Data:

1. Piping: Submit data on pipe materials, fittings, and accessories.
2. Hangers and Supports: Submit manufacturers catalog information including load capacity.
3. Sanitary Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.

B. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

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

1.04 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.01 SANITARY SEWER AND VENT PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74, service weight.

1. Fittings: Cast iron.
2. Joints: ASTM C564, neoprene gasket system.

B. Cast Iron Pipe: CISPI 301, hub-less, service weight.

1. Fittings: Cast iron.
2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

C. Copper Tube: ASTM B306, DWV Type M.

1. Fittings: ASME B16.23, cast bronze, or ASME B16.29, wrought copper.
2. Joints: ASTM B32, solder, Grade 50B.

- D. Copper Pipe: ASTM B42.
 - 1. Fittings: ASME B16.23, cast bronze, or ASME B16.29 wrought copper.
 - 2. Joints: ASTM B32, solder, Grade 50B.
- E. Brass Pipe: ASTM B43, chrome plated.
 - 1. Fittings: ASME B16.23, cast bronze, chrome plated.
 - 2. Joints: Mechanical compression.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION - ABOVE GROUND PIPING

- A. Establish invert elevations, slopes for drainage to 1/4 inch per foot minimum for piping under 4 inches and 1/8 inch per foot minimum for 4 inch piping where necessary due to structural conditions. Maintain gradients.
- B. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearances at cleanout for snaking drainage system.
- C. Install floor cleanouts at elevation to accommodate finished floor.
- D. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- E. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- F. Install piping to maintain headroom. Do not spread piping, conserve space.
- G. Group piping whenever practical at common elevations.
- H. Rigidly anchor pipe to building structure. Provide pipe guides to direct movement only along axis of pipe. Erect piping so strain and weight is not on cast connections or apparatus.
- I. Provide support and anchors for controlling expansion and contraction of piping. Provide loops, pipe offsets, as indicated on Drawings.

- J. Provide expansion loops as indicated on Drawings.
- K. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 15080.
- L. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Section 08311.
- M. Install piping penetrating roofed areas to maintain integrity of roof assembly.
- N. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- O. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
- P. Sleeve pipes passing through partitions, walls and floors.
- Q. Support cast iron drainage piping at every joint.

END OF SECTION

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SECTION 15191
FUEL OIL PIPING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Fuel oil piping.
 2. Unions.
 3. Valves.
 4. Filters.
 5. Flexible connectors.
 6. Accessories.
 7. Aboveground fuel oil storage tanks

1.02 REFERENCES

- A. American Society of Mechanical Engineers:
1. ASME B16.3 - Malleable Iron Threaded Fittings.
 2. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
 3. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 4. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
 5. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.
- B. ASTM International:
1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

3. ASTM B32 - Standard Specification for Solder Metal.
4. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
5. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
6. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

C. National Fire Protection Association:

1. NFPA 30 - Flammable and Combustible Liquids Code.
2. NFPA 31 - Standard for the Installation of Oil-Burning Equipment.

1.03 QUALITY ASSURANCE

- A. Perform Work in accordance with NFPA 30 and NFPA 31.
- B. Perform Work in accordance with ASME B31.1 code for installation of piping systems and ASME Section IX for welding materials and procedures.
- C. Perform Work in accordance with State of Alaska standard.

1.04 ENVIRONMENTAL REQUIREMENTS

- A. Do not install tank foundations when bedding is wet or frozen.

1.05 SUBMITTALS

- A. Section 01300 - Submittal Procedures: Submittal procedures.
- B. Product Data:
 1. Piping: Provide list of piping type and classification that will be provided on the project. No product submittal required for piping.
 2. Submit manufacturer's catalog information for fuel oil valves and accessories.

PART 2 - PRODUCTS

2.01 FUEL OIL PIPING

- A. Copper Tubing: ASTM B88, Type K, hard drawn.

1. Fittings: ASME B16.18 cast copper alloy or ASME B16.22 wrought copper and bronze.
 2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.
- B. Copper Tubing: ASTM B88, Type K, annealed.
1. Fittings: ASME B16.26 cast bronze.
 2. Joints: Flared.
- C. Steel Pipe: ASTM A53/A53M or ASME B36.10M Schedule 40 black.
1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M wrought carbon steel and alloy steel welding type.
 2. Joints: Threaded for pipe 2-inch and smaller; welded for pipe 2-1/2 inches and larger.

2.02 UNIONS

- A. Unions for Pipe 2 inches and Smaller:
1. Ferrous Piping: Class 150, malleable iron, threaded.
 2. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.03 BALL VALVES

- A. 1/4 inch to 1 inch: MSS SP 110, Class 125, two piece, full port, threaded ends, bronze or brass body, chrome plated bronze ball, Viton or Buna-N double o-rings, lever handle, UL 842 listed for flammable liquids and LPG, full port.

2.04 CHECK VALVES

- A. Horizontal Swing Check Valves:
1. 2 inches and Smaller: ANSI B1.20.1, Class 125 bronze body and cap, bronze or brass seat, brass or Viton or Buna-N disc, threaded ends.

2.05 FUEL OIL FILTERS

- A. Manufacturer: General Filter Model 2A-700 or approved equal.

- B. UL listed, 12 psi working pressure, 25 GPH firing rate, 25 micron wool felt filtering media with 83 square inch filtering surface, and 3/4 inch threaded connections.

2.06 FLEXIBLE CONNECTORS

- A. 2 inches and Smaller: Corrugated stainless steel or bronze inner hose with single layer of Type 304 stainless steel exterior braiding, minimum 24 inches long with copper tube ends.

2.07 OIL DE-AERATOR

- A. Manufacturer: Tigerholm Tigerloop model TON110A or approved equal.
- B. UL Listed oil de-aerator with glass bulb and 3/8 inch NPT connections. Rated for maximum nozzle capacity of 20 GPH, inlet pressure of 8 PSI, and 105 degree F.

2.08 ABOVEGROUND FUEL OIL STORAGE TANK

- A. Manufacturers:
 - 1. Greer
 - 2. Anchorage tank
 - 3. ACE Tank
- B. Product Description: Aboveground, double wall, steel storage tank. Manufactured in accordance with UL 142 and labeled.
- C. Storage Tank: Welded steel, round with integral steel support skid.
- D. Finish: Commercial grit blast (SSPC-6), epoxy primer coat. Exterior coat to be marine grade epoxy or approved polyurethane coating.
- E. Storage Tank: Fabricated with the following:
 - 1. Threaded connections, as indicated on the Drawings. Furnish thread protectors inserted in threaded openings prior to shipment.
 - 2. 4 inch 150 Class flanged connections with flange protectors, as indicated on the Drawings.

- F. Accessories:
1. Manway 22 inches in diameter with bolted and gasketed lid.
 2. Emergency vent, 2 each.
 3. Standard and interstitial tank vent, routed to minimum 12 ft above grade.
 4. 7-1/2 gallon spill container, lockable with drain valve.
 5. Overfill prevention valve and drop tube.
 6. Locking cap for visual level indication.
 7. Clock fuel level gauge.
 8. Tank bushings as appropriate.
 9. OSHA ladder and platform with OSHA-approved handrails.
 10. Refer to Drawings for additional features and configuration.
- G. Loose Accessories To Be Provided to Owner
1. Rotary hand pump with drop tube for 55 gallon drums.
 2. Electric drum pump set with drop tube for 55 gallon drums, 120 volt power.
 3. Delivery hose and nozzle, of sufficient length to get from grade to fill connection.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Division 1 - Administrative Provisions: Coordination and project conditions.

3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION - ABOVEGROUND PIPING

- A. Install fuel oil piping in accordance with NFPA 31.
- B. Provide a water tight pan under the burner and all oil piping valves, tigerloop, filter, and trim.
- C. Provide non-conducting dielectric connections wherever jointing dissimilar metals. Install in accordance with NACE RP-01-69.
- D. Route piping in orderly manner and maintain gradient.
- E. Install piping to conserve building space and not interfere with use of space.
- F. Group piping whenever practical at common elevations.
- G. Provide clearance for installation of insulation and access to valves and fittings.
- H. Where pipe support members are welded to structural building framing, scrape, brush clean, weld, and apply one coat of zinc rich primer.
- I. Install identification on piping systems including underground piping. Refer to Section 15075.
- J. Install valves with stems upright or horizontal, not inverted.
- K. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

3.04 INSTALLATION - ABOVEGROUND TANKS:

- A. Install aboveground tanks in accordance with API 1615, PEI 100, NFPA 30, and NFPA 31.
- B. Check factory installed equipment and accessories for loosening during transit.
- C. Clean and flush tanks prior to delivery to site. Seal until pipe connections are made.
- D. Install aboveground tank supports in accordance with authority having jurisdiction.
- E. Install grounding for aboveground tanks in accordance with Division 16.
- F. Protect aboveground tanks by installing pipe bollards and/or fencing spaced, as indicated on Drawings.

- G. Install piping connections to tanks. Provide venting in accordance with API 2000.
- H. Adjust liquid level gages before initial start-up and after filling of tank.
- I. Fill tanks completely at Project turnover with appropriate fuel.
- J. Route primary and interstitial vent pipes 12 feet above grade.

3.05 FIELD QUALITY CONTROL

- A. Pressure test fuel oil piping in accordance with NFPA 31.
- B. Pressure test fuel oil piping with 100 psi air pressure. Duration of each test shall be not less than 24 hours.

END OF SECTION

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SECTION 15410
PLUMBING FIXTURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Water closets.
- B. Urinals.
- C. Lavatories.
- D. Showers.
- E. Sinks.
- F. Service Sinks.
- G. Drinking Fountains.
- H. Clothes Washer Box.
- I. Hose Bibs.
- J. Thermostatic Mixing Valves.
- K. Water Hammer Arrestors.
- L. Trap Primer Valves.
- M. Floor Drains.
- N. Floor Sinks.
- O. Lint Interceptor.
- P. Cleanouts.

1.02 REFERENCES

- A. American Society of Mechanical Engineers:
 - 1. ASME A112.6.1 - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use.

2. ASME A112.18.1 - Plumbing Fixture Fittings.
 3. ASME A112.19.2M - Vitreous China Plumbing Fixtures.
- B. American Society of Sanitary Engineering:
1. ASSE 1016 – Individual, Thermostatic Pressure Balancing and Combination Pressure Balancing and Thermostatic Control Valves for Individual Showers and Tubs/Shower Combinations.
 2. ASSE 1017 – Temperature Actuated Mixing Valves for Hot Water Distribution Systems.
 3. ASSE 1070-2004 – Performance Requirements for Water Temperature Limiting Devices.

1.03 SUBMITTALS

- A. Division 1 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. Manufacturer's Installation Instructions: Submit installation methods and procedures.

1.04 CLOSEOUT SUBMITTALS

- A. Division 1 - Execution Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit fixture, trim, exploded view and replacement parts lists.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with Municipality of Anchorage standard.
- B. Provide products requiring electrical connections listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.

1.06 QUALIFICATIONS

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

PART 2 - PRODUCTS

2.01 FLUSH VALVE WATER CLOSETS

- A. Manufacturers:
1. Sloan Valve Co. Model 8111.
 2. Crane Plumbing Model 3-446E "Placidus 1.5".
 3. Bemis Manufacturing Co., model 1955 C.
 4. Josam Co. Series 12600.
 5. Substitutions: Division 1 - Product Requirements.
- B. Bowl: ASME A112.19.2M; wall hung, siphon jet vitreous china closet bowl, with elongated rim, 1-1/2 inch top spud, china bolt caps.
- C. Sensor Operated Flush Valve: ASME A112.18.1; exposed chrome plated , diaphragm type with battery powered, low voltage operated solenoid operator, infrared sensor and over-ride button in chrome plated plate, wheel handle stop and vacuum breaker; maximum 1.6 gallon flush volume.
- D. Seat: Solid white plastic, open front, extended back, self-sustaining hinge, stainless steel bolts, without cover.
- E. Wall Mounted Carrier: ASME A112.6.1; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.
- F. Unless otherwise noted, where trap primers for floor drains are called for on construction drawings, provide a "-TP" variation with a VBF-72-A1 vacuum breaker trap primer on flush valve serving water closet convenient to the floor drain.

2.02 WALL HUNG URINALS

- A. Manufacturers:
1. Sloan Valve Co. Model 8186-1.0.
 2. Crane Plumbing Model 7-187E "Cromwell".
 3. Josam Co. Series 17560
 4. Substitutions: Division 1 - Product Requirements.

- B. Urinal: ASME A112.19.2M; vitreous china, wall hung washout urinal with shields, integral trap, removable stainless steel strainer, 3/4 inch top spud, steel supporting hanger.
- C. Sensor Operated Flush Valve: ASME A112.18.1; exposed chrome plated, diaphragm type with battery powered, low voltage operated solenoid operator, infrared sensor and over-ride button in chrome plated plate, wheel handle stop and vacuum breaker; maximum 1 gallon flush volume.
- D. Wall Mounted Carrier: ASME A112.6.1; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

2.03 LAVATORIES

- A. Manufacturers:
 - 1. Crane Plumbing.
 - 2. Sloan Valve Co., Delta Faucet Co.
 - 3. Substitutions: Division 1 - Product Requirements.
- B. Counter Mounted Lavatory: ASME A112.19.2; vitreous china counter mounted lavatory, 20 inch x 17 inch minimum basin, self rimming with front overflow, seal of putty, caulking, or concealed vinyl gasket, drillings on 4 inch centers. Compliant with Americans with Disabilities Act when mounted on 12 inch centerline from front of countertop and rim height of 34 inches maximum. Crane Plumbing model 1287 "Sonnet" or approved equal.
 - 1. Trim : ASME A112.18.1M; ASSE-1070 compliant, chrome plated metered mixing faucet with solenoid operator and infrared sensor, below deck hot water thermostatic mixing valve, open grid strainer, chrome plated combination supply spout with deck gasket, water economy aerator with maximum 0.5 gpm flow , vandal resistant aerator. Sloan Valve Co. model ETF-80-BDT or approved equal.
- C. Accessories:
 - 1. Chrome plated 17 gage brass P-trap and arm with escutcheon.
 - 2. Offset waste for wheelchair access, with perforated open strainer.
 - 3. Screwdriver stops.
 - 4. Rigid supplies.

5. Coordinate drain piping, water supply fittings, valves and appurtenances with under counter apron installation per architectural to eliminate interference with apron installation.
6. Where fittings are exposed, trap, waste and supply fittings shall be insulated and offset to meet ADA compliance with manufactured insulation kits, Plumberex Pro-2000 Series or approved equal.

2.04 SHOWER

- A. Manufacturers:
 1. Crane Plumbing/ model G3636.54F.
 2. Substitutions: Division 1 - Product Requirements.
- B. Cabinet: ANSI Z124.2 molded, sanitary grade, high gloss polyester gelcoat with reinforced composite matrix, 36 x 36 x78-1/4 inch high inside dimensions, with integral receptor, integral seat, grab bars, slide bar, supply controls located on side wall, removable chrome plated strainer, tailpiece.
- C. Trim: ASME A112.18.1; ASSE-1016 compliant, concealed shower supply with pressure balanced mixing valves, integral service stops, hand held shower with 69 inch metal clad hose with in-line vacuum breaker, and slide bar, female inlet. Delta model 11T5143 or approved equal.

2.05 ADA SHOWER

- A. Manufacturers:
 1. Crane Plumbing/Fiat Products model A 6036.01F R/L.
 2. Substitutions: Division 1 - Product Requirements.
- B. Cabinet: ANSI Z124.2 thermo-formed cast acrylic, 60 x 36 x 84 inch high, one-piece seamless unit, reinforced with a fiberglass strand/polyester resin mix, with integral receptor with anti-skid floor, soap dish, integral fold-up seat with phenolic slats, removable chrome plated strainer, tailpiece, white in color. Shower module shall have a backside fire rating of "A" and flame spread rating of 25.
 1. Shower module shall be set in a pit recessed 7/8 inches into the floor slab to bring the finished floor level with the top of the shower threshold.
 2. The shower module shall be set level in a bed of mortar with any clearances between the shower base and the pit floor filled with mortar.

- C. Trim: ASME A112.18.1; ASSE-1016 compliant, concealed shower supply with pressure balanced mixing valves, integral service stops, hand held shower with 69 inch metal clad hose with in-line vacuum breaker, and slide bar, female inlet. Delta model 11T5143 or approved equal.

2.06 SINKS

- A. Manufacturer:
1. Just Manufacturing model #TE-1944-AGR.
 2. Delta Faucets model #340-DST.
 3. Substitutions: Division 1 - Product Requirements.
- B. Three Compartment Bowl: ASME A112.19.3; 44 x 21 x 7-1/2 inch outside dimensions, 18 gage thick, Type 304 stainless steel. Self-rimming and undercoated, with 1-1/2 inch chromed brass drain 3-1/2 inch crumb cup and tailpiece, ledge back drilled for trim.
- C. Trim: ASME A112.18.1; single handle kitchen deck faucet for exposed mounting, polished chrome plated solid brass fabricated body, 9-3/16 inch long swing spout with lever handle, indexed red and blue button on handle, single-handle lever operator with rotating stainless steel ball-type control mechanism with replaceable non-metallic seats operating in stainless steel lined sockets, pull-out hand held spray with anti-siphon device integral to valve body, water economy aerator with maximum 2.2 gpm flow.
- D. Accessories:
1. Chrome plated 17 gage brass P-trap and arm with escutcheon.
 2. Offset waste for wheelchair access when exposed.
 3. Chrome plated basket strainers.
 4. Screwdriver stops.
 5. PEX flexible supplies
 6. Where supplies and drain are exposed, trap, waste, and water supply fittings insulated and offset to meet ADA compliance with manufactured insulation kits, Plumberex Pro-2000 Series or approved equal.

2.07 SERVICE SINKS

- A. Manufacturers:
 - 1. Kohler model K-6650.
 - 2. Chicago Faucet model 897-CP.
- B. Sink: ASME-112.19.2; Wall mounted vitreous china service sink, 7-inch high backsplash, stainless steel rim guards on front and sides, back drilled for two-hole faucet installation, 2" p-trap standard, wall brackets, stainless steel basket strainer.
- C. Trim: ASME A112.18.1 wall type supply with smooth polished chrome finish, exposed lever handles, spout wall brace, vacuum breaker, hose end spout, strainers, adjustable supply inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges.
- D. Accessories:
 - 1. 3 feet of ½" diameter plain end reinforced rubber hose.
 - 2. Hose clamp hanger.

2.08 DRINKING FOUNTAIN

- A. Manufacturers:
 - 1. Haws Corporation or approved equal.
- B. Fountain : Barrier free, wall mounted stainless steel, Type 304, with elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, access cover plate, mounting bracket, screwdriver stop. Haws model 1001 or approved equal with model 6700 mounting plate.

2.09 WASHUP SINK

- A. Manufacturers:
 - 1. Just Manufacturing, model A-33338.
 - 2. Delta Faucets model 27T3335
 - 3. Substitutions: Division 1 - Product Requirements.
- B. Wall mounted sink, 18 gauge Type 304 stainless steel seamless welded construction, 18 inches x 20 inches wide x 5 inches deep with rolled sink edges. All exposed interior surfaces polished finish, brushed finish on exterior exposed

surfaces, three inch high backsplash, polished chrome plated grid strainer, Just model J-35-FS, polished chrome plated p-trap and tailpiece, stainless steel wall brackets and wall clip.

- C. Trim: ASME A112.18.1 cast brass deck mount sink faucet, polished chrome plated finish with two 6 inch lever handles, 6 inch swing spout, 4 inch centers, 2 GPM laminar flow aerator.

2.10 HOSE BIBS

- A. Manufacturers:
 - 1. Acorn Engineering, Woodford.
 - 2. Substitutions: Section 01600 - Product Requirements.
- B. Interior Mixing: Recessed wall box with wall flange, locking cover, built-in drip lip, cast bronze double service faucet with hose thread spout, integral stops, chrome plated where exposed with hand wheels, and vacuum breaker in conformance with ASSE 1011. Acorn Engineering model #8109.
- C. Interior Hose Bib: Interior: Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with hand wheel vacuum breaker in conformance with ASSE 1011. Woodford Model 24 or approved equal.

2.11 CLOTHES WASHER BOX

- A. Manufacturers:
 - 1. IPS Corporation/Guy Gray Manufacturing Company model #WB200 or approved equal.
- B. Recessed wall mounted hot dipped galvanized steel wall box with duo-close faucet fittings utilizing a single lever handle operating cold and hot water quarter-turn ball valves, 2" drain connection, wall flange.

2.12 WATER HAMMER ARRESTORS

- A. Manufacturers:
 - 1. Zurn Model Shoktrol Z-1700.
 - 2. Substitutions: Section 01600 - Product Requirements.
- B. ASSE 1010; stainless steel construction, bellows type sized in accordance with PDI WH-201.

- C. Pre-charged suitable for operation in temperature range 34 to 250 degrees F and maximum 150 psi working pressure.

2.13 TRAP PRIMER VALVES

- A. Manufacturers:
 - 1. Precision Plumbing Products Model PR-500.
 - 2. Precision Plumbing Products Model DU-U.
 - 3. Substitutions: Section 01600 - Product Requirements.
- B. ASSE 1018; Automatic floor drain trap primer valve, brass construction with integral vacuum breaker, designed to operate with 5 PSI pressure drop, capable of priming up to 4 floor drain traps. O-ring seals designed for -40 to 450 degrees F.
- C. Provide manufactured trap primer distribution units where trap primer is to prime multiple floor drains. Provide isolation valve, union, and provide access panels in finished areas where piping and valves are concealed.

2.14 THERMOSTATIC MIXING VALVES

- A. For Kitchen Hand Wash Sink Tempered Hot Water
 - 1. Manufacturers:
 - 2. Powers HdoroGuard model LM491-1 or approved equal.
 - 3. Thermostatic tempering valve (ASSE 1017-2003 listed and CSA B125 certified).
 - 4. Valve shall be solid brass with corrosion resistant internal components and shall feature advanced paraffin –based actuation technology and union connections, temperature adjustment stem with locking nut to prevent tampering. Valve shall provide control down to 0.5 gpm and shall be adjustable between 90 degrees F. and 160 degrees F. Valve shall have capacity of 23 gpm at 45 psig differential and contain integral checks with screens to prevent crossflow and to filter debris. Inlet and outlet ports shall be 1/2 inch NPT.

2.15 FLOOR DRAINS

- A. Manufacturer: Josam Company Series 30000A-17-50
 - 1. ASME A112.21.1; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer, trap primer connection.

2.16 FLOOR SINKS

- A. Manufacturer: Josam Company model 49340A-4 or approved equal.
 - 1. Square cast iron flanged receptor, 12" square nickel bronze anti-tilting grate, clamping flange, 1/2" grate, lacquered cast iron body, 8" deep, with integral seepage pan, epoxy coated acid resisting interior, aluminum dome strainer, clamp collar. Josam Series 49340A-4 or approved equal.

2.17 LINT INTERCEPTOR

- A. Manufacturer:
 - 1. Zurn Industries model Z-1185 or approved equal.
 - 2. Floor mounted, fabricated steel lint interceptor with gasketed, air-tight non-skid bolted cover, acid-resistant coated interior and exterior, stainless steel lint intercepting secondary screen assembly and permanent primary standing baffle, up to 70 GPM capacity, 25" x 25" x 20" high.

2.18 CLEANOUTS

- A. Manufacturers:
 - 1. J.R. Smith, Josam Co., Zurn Industries.
 - 2. Substitutions: Section 01600 - Product Requirements.
- B. Floor Cleanouts: Lacquered cast iron body with anchor flange, adjustable threaded top assembly, and round scored extra heavy-duty nickel bronze top with gasket, vandal proof top, with bronze gasketed plug.
- C. Interior Finished Wall Areas: Line type with lacquered cast iron body and round epoxy coated cover with gasket, and round stainless steel access cover secured with machine screw.
- D. Interior Unfinished Accessible Areas Wall Cleanouts: Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders and waste stacks.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install Work in accordance with Uniform Plumbing Code.
- B. Install each fixture with trap, easily removable for servicing and cleaning.
- C. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.
- D. Install components level and plumb.
- E. Install and secure fixtures in place with wall carriers and bolts.
- F. Seal fixtures to wall and floor surfaces with sealant as specified in Division 7, color to match fixture.

3.02 INTERFACE WITH OTHER PRODUCTS

- A. Review millwork shop-drawings. Confirm location and size of fixtures and openings before rough in and installation.

3.03 ADJUSTING

- A. Division 1 - Execution Requirements: Testing, adjusting, and balancing.
- B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.04 CLEANING

- A. Division 1 - Execution Requirements: Final cleaning.
- B. Clean plumbing fixtures and equipment.

3.05 PROTECTION OF INSTALLED CONSTRUCTION

- A. Division 1 - Execution Requirements: Protecting installed construction.
- B. Do not permit use of fixtures before final acceptance.

PART 4 - SCHEDULES

4.01 FIXTURE MOUNTING HEIGHTS

- A. Water Closet:
 - 1. Standard: 15 inches to top of bowl rim.
 - 2. Accessible: 17 inches to top of rim.
- B. Water Closet Flush Valves:
 - 1. Standard: 11 inches min. above bowl rim.
- C. Urinal:
 - 1. Standard: 22 inches to top of bowl rim.
 - 2. Accessible: 17 inches to top of bowl rim.
- D. Urinal Flush Valves:
 - 1. Standard: 53.75 inches above finished floor.
 - 2. Accessible: 44 inches above finished floor.
- E. Lavatories:
 - 1. Standard is 34 inches to top of basin rim.
 - 2. Accessible: 34 inches to top of basin rim.
- F. Sinks:
 - 1. Standard: 31 inches to top of basin rim.
 - 2. Accessible: 34 inches to top of basin rim.
- G. Drinking Fountain:
 - 1. Accessible: 36 inches to spout.

END OF SECTION

SECTION 15430

PLUMBING SPECIALTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following plumbing specialties:
 - 1. Drain valves.
 - 2. Expansion Tanks
 - 3. Hydro-pneumatic well pressure tanks.
 - 4. Water Filters.

1.03 DEFINITIONS

- A. The following are industry abbreviations for plastic piping materials:
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 2. PE: Polyethylene plastic.
 - 3. PUR: Polyurethane plastic.
 - 4. PVC: Polyvinyl chloride plastic.

1.04 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:
 - 1. Domestic Water Piping: 125 psig.
 - 2. Sanitary Waste and Vent Piping: 10-foot head of water.
 - 3. Storm Drainage Piping: 10-foot head of water.

1.05 SUBMITTALS

- A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections.

1.06 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of plumbing specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- B. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.
- C. NSF Compliance:
 - 1. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

PART 2 - PRODUCTS

2.01 DRAIN VALVES

- A. Hose-End Drain Valves: MSS SP-110, NPS 3/4 ball valve, rated for 400-psig minimum CWP. Include two-piece, copper-alloy body with standard port, chrome-plated brass ball, replaceable seats and seals, blowout-proof stem, and vinyl-covered steel handle.
 - 1. Inlet: Threaded or solder joint.
 - 2. Outlet: Short-threaded nipple with ASME B1.20.7, garden-hose threads and cap.

2.02 DIAPHRAGM-TYPE EXPANSION TANKS

- A. Domestic Hot Water:
 - 1. Manufacturer
 - a. Amtrol ST-12-C or approved equal.
 - 2. Construction: Welded steel outer shell, tested and stamped in accordance with ASME Section VIII; Polypropylene liner, NSF Listed for use with potable water, rated for working pressure of 150 psig, 200 Deg. F. maxi-

imum temperature, with flexible heavy duty Butyl diaphragm sealed into tank, pre-charged to 40 PSI, adjustable. Stainless steel connection components. Factory corrosion resistant finish.

- B. Hydropneumatic Well Pressure Tanks
 - 1. Manufacturer:
 - a. Amtrol WX-452-C or approved equal.
 - 2. Construction: Welded steel, tested and stamped in accordance with ASME Section VIII; rated for maximum working pressure of 150 psig and 240 degrees F, 211 gallon capacity, 30" diameter x 91" tall, heavy duty butyl rubber diaphragm, NSF Listed, red oxide primer and steel support stand.
 - 3. Accessories: Air-charging fitting, pre-charge to 55 psig, malleable iron piping connections.

2.02 WATER FILTERS

- A. Domestic water filters:
 - 1. Construction: Brass body with engineered plastic sump, integral back-flush drain and valve with barbed connection, bronze pressure gauge.
 - 2. Strainer: 50 micron, stainless steel screen.
 - 3. Basis of design: Honeywell Braukmann model F76B or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.
- B. Install strainers on supply side of well tank.
- C. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow. Provide isolation valve prior to trap primer valve.
- D. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.

- E. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.
- F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Position floor drains for easy access and maintenance.
 - 2. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 - 3. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- G. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.02 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Connect plumbing specialties to piping specified in other Division 15 Sections.

3.03 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 15441

DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. All-bronze and bronze-fitted centrifugal pumps for domestic and hot water circulation.
 - 2. Convertible Jet Pumps.

1.02 SUBMITTALS

- A. Product Data: For each type and size of domestic water pump specified. Include performance curves with operating points; and rated capacities of selected models, furnished specialties, accessories.
- B. Operation and maintenance data.

1.03 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

PART 2 - PRODUCTS

2.01 IN-LINE CIRCULATOR PUMPS

- A. Manufacturers: Bell & Gossett.
 - 1. Casing: Bronze rated for 125 psig working pressure.
 - 2. Impeller: non-metallic.
 - 3. Shaft: Ceramic with integral thrust collar and two, oil lubricated bronze sleeve bearings.
 - 4. Seal: Carbon rotating against ceramic seat.

2.02 CONVERTIBLE JET PUMP

- A. Description: Self priming shallow jet pump, UL listed..
- B. Impeller: Noryl or approved equal FDA approved material.
- C. Shaft: Stainless steel.
- D. Motor: NEMA standard, Rated for continuous use. 3500 RPM, single stage, built-in overload with automatic reset. UL778 Listed.
- E. Trim: Pressure switch with tubing and fittings, pressure gauge and bushing.
- F. Provide 2" x 4" steel channel base for secure mounting to wood floor.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
- B. Install pump with motor and pump shafts horizontal.
- C. Provide priming cup on inlet of pump.
- D. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- E. Install piping adjacent to pumps to allow service and maintenance.
- F. Ground equipment according to Division 16 Section "Grounding and Bonding."
- G. Connect wiring according to Division 16 Section "Conductors and Cables."

END OF SECTION

SECTION 15450

POTABLE-WATER STORAGE TANKS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Plastic, non-pressure, potable water storage tanks.

1.02 SUBMITTALS

- A. Product Data: For each type of potable-water storage tank indicated. Include dimensions, materials, weights, pressure ratings, and listings.

1.03 QUALITY ASSURANCE

- A. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic potable-water storage tanks and components. Include appropriate NSF marking.
- B. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 to 9," for potable-water storage tanks. Include appropriate NSF marking.

PART 2 - PRODUCTS

2.01 PLASTIC, NONPRESSURE, POTABLE-WATER STORAGE TANKS

- A. PE, Potable-Water Storage Tanks:
 - 1. Manufacturer:
 - a) Greer Tank, model PE500 or approved equal.
 - 2. Description: 500 gallon capacity, PE, vertical, flat-bottom, 62" diameter x 45-1/8" high, non-pressure-rated water tank; complying with NSF 61 barrier materials for potable-water tanks.
 - 3. Construction: ASTM D 1998, molded PE.
 - 4. Vertical Tank Support: Separate factory-fabricated steel stand, capable of supporting entire bottom of tank.
- B. Manhole: Watertight, for tank more than 16 inches in diameter.

- C. Cover for Open Tank: Plastic, same as or similar to tank material and with shape that encloses top of tank.
- D. Specialties and Accessories: Include free air vent with insect screen; gage glass, brass fittings, compression stops, and gage-glass guard.
- E. Floats: Provide floats and controls for following actions:
 - 1. Water Level for fill function
 - 2. Low Level for shutting down of distribution pressure pump.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install water storage tanks level and plumb, firmly anchored. Arrange so devices needing servicing are accessible.
- B. Anchor tank supports and tanks to substrate.

3.02 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to potable-water storage tanks to allow service and maintenance.
- C. Connect water piping to water storage tanks with unions or flanges and with shutoff valves. Connect tank drains with shutoff valves and discharge over closest floor drains.
 - 1. General-duty valves are specified in Division 15 Section "Valves."
 - a. Valves NPS 2 and Smaller: Ball.
 - b. Valves NPS 2-1/2 and Larger: Gate or ball.
 - c. Drain Valves: NPS 3/4 gate or ball valve. Include outlet with, or nipple in outlet with, ASME B1.20.7, 3/4-11.5NH thread for garden-hose service, threaded cap, and chain.
 - 2. Water Piping Connections: Make connections to dissimilar metals with dielectric fittings. Dielectric fittings are specified in Division 15 Section "Basic Mechanical Materials and Methods."

3. Connect air piping to hydropneumatic tanks with unions or flanges and gate or ball valves. Make connections to dissimilar metals with dielectric fittings, which are specified in Division 15 Section "Basic Mechanical Materials and Methods."

3.03 FIELD QUALITY CONTROL

- A. Perform the following final checks before filling:
 1. Verify that air precharge in precharged tanks is correct.
 2. Test operation of tank accessories and devices.
- B. Filling Procedures: Follow manufacturer's written procedures. Fill tanks with water to operating level.

END OF SECTION

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SECTION 15481

FUEL-FIRED DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Oil-fired water heaters.

1.02 REFERENCES

- A. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. American Society of Mechanical Engineers:
 - 1. ASME PTC 25 - Pressure Relief Devices.
 - 2. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.
- C. National Fire Protection Association:
 - 1. NFPA 31 - Standard for the Installation of Oil-Burning Equipment.
- D. United States Department of Energy:
 - 1. DOE 10 CFR - Uniform Test Method for Measuring the Energy Consumption of Furnaces.

1.03 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Product Data:
 - 1. Water Heaters: Submit dimensioned drawings of water heaters indicating components and connections to other equipment and piping. Indicate pump type, capacity and power requirements. Submit electrical characteristics and connection locations.

1.04 CLOSEOUT SUBMITTALS

- A. Section 01700 - Execution Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit replacement part numbers and availability.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Product Requirements: Products storage and handling requirements.
- B. Accept water heaters on site in original labeled cartons. Inspect for damage.
- C. Protect tanks with temporary inlet and outlet caps. Maintain caps in place until installation.

1.06 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.01 OIL FIRED WATER HEATERS

- A. Manufacturers:
 - 1. Bock
 - 2. Substitutions: Division 1
- B. Type: Automatic, oil-fired, vertical storage.
- C. Tank: Glass lined welded steel with single flue passage, flue baffle and draft hood; thermally insulated with glass fiber and encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.
- D. Controls: Automatic water thermostat, temperature range adjustable from 120 to 170 degrees F, flame retention oil burner, safety high limit control.
- E. Annodes: Dual Magnesium anode rods.
- F. Accessories: Water connections and dip tube, drain valve, magnesium anodes, and temperature and pressure relief valve.
- G. Water Pan: Provide 2 inch high water pan under water heater.

- H. Warranty: 3 year factory warranty.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Mount unit on water pan.
- B. Maintain manufacturer's recommended clearances around and over water heaters.
- C. Connect fuel oil piping in accordance with NFPA 31.
- D. Connect fuel oil piping to water heater, full size of water heater gas train inlet. Arrange piping with clearances for burner removal and service.
- E. Connect domestic cold water piping to supply and return water heater connections.
- F. Install discharge piping from relief valves and drain valves to within 6 inches of water pan.
- G. Install water heater trim and accessories furnished loose for field mounting.
- H. Install electrical devices furnished loose for field mounting.
- I. Install control wiring between water heater control panel and field mounted control devices.
- J. Connect flue to water heater outlet, full size of outlet. Refer to Section 15550.

END OF SECTION

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SECTION 15540

FUEL-FIRED EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUBMITTALS

- A. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.
- B. Operation and Maintenance Data:
 - 1. Provide in accordance with Section 15010 and Division 1.
 - 2. Provide operation and maintenance manuals.

1.03 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.01 OIL-FIRED SPACE HEATERS

- A. Manufacturer:
 - 1. Monitor Model 441, no substitutions.
- B. Flue: Concentric flue system with outside air drawn through a pipe-within-a-pipe vent.
- C. Controls: Integral electric controls.

- D. Accessories:
1. Wind deflector.
 2. Spill tray under entire unit.
 3. Electric lifter fuel pump, from Monitor.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in for flue, fuel oil piping, and equipment to verify actual locations of piping connections before equipment installation.
- B. Verify proper clearances from combustibles.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install equipment level and plumb.
- B. Install equipment in accordance with manufacturer's installation recommendations.
- C. Install and connect oil-fired equipment and associated fuel and vent piping according to NFPA 31, applicable local codes and regulations, and manufacturer's written installation instructions.

3.03 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Fuel Oil Piping: Comply with applicable requirements in Division 15 Section "Fuel Oil Piping." Connect to fuel oil supply and return piping with shutoff valve and union at each connection.
- D. Connect vents according to manufacturer's instructions. Maintain 10 feet minimum from outside air intakes, doors, and operable windows.

- E. Electrical: Comply with applicable requirements in Division 16 Sections.
 - 1. Install electrical devices furnished with heaters but not specified to be factory mounted.
- F. Ground equipment according to Division 16 Section "Grounding and Bonding."
- G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

END OF SECTION

SECTION 15550

BREECHING, CHIMNEYS, AND STACKS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Double wall metal stacks.
 - 2. Induced draft fans.

1.02 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI Z95.1 - Oil Burning Equipment, Installation.
- B. ASTM International:
 - 1. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - 2. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 3. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 - 4. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - 5. ASTM C401 - Standard Classification of Alumina and Alumina-Silicate Castable Refractories.
- C. National Fire Protection Association:
 - 1. NFPA 31 - Standard for the Installation of Oil-Burning Equipment.

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- D. Sheet Metal and Air Conditioning Contractors:
 - 1. SMACNA - Guide for Steel Stack Construction.
 - 2. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
- E. Underwriters Laboratories Inc.:
 - 1. UL 378 - Draft Equipment.
 - 2. UL 641 - Type L Low-Temperature Venting Systems.
 - 3. UL 959 - Medium Heat Appliance Factory Built Chimneys.

1.03 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittals procedures.
- B. Shop Drawings: Indicate general construction, dimensions, weights, support and layout of breeching. Submit layout drawings indicating plan view and elevations.
- C. Draft Calculations: Provide draft calculations or manufacturer's installation requirements showing clearly that proposed sizing and routing meet manufacturer's recommendations.
- D. Product Data: Submit data indicating factory built chimneys, including dimensional details of components and flue caps, dimensions and weights, electrical characteristics and connection requirements.
- E. Manufacturer's Installation Instructions: Submit assembly, support details, and connection requirements.

PART 2 - PRODUCTS

2.01 DOUBLE WALL METAL STACKS

- A. Furnish double wall metal stacks, tested to UL 103 and UL listed, for use with building heating equipment, in compliance with NFPA 211.
- B. Fabricate with 1 inch minimum air space between walls. Construct inner jacket of 20 gage ASTM A167 Type 304 or Type 316 stainless steel. Construct outer jacket of Type 304 or Type 316 stainless steel.
- C. Accessories, UL labeled:
 - 1. Stack caps or sidewall termination kits listed with the appliance.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Provide double wall piping from appliance to termination. Breechings sections are not allowed.
- B. Coordinate installation of dampers, and induced draft fans.
- C. Provide barometric dampers as recommended by equipment manufacturer.
- D. Assemble and install stack sections in accordance with NFPA 82, industry practices, and in compliance with UL listing. Join sections with acid-resistant joint cement. Connect base section to foundation using anchor lugs.
- E. Level and plumb chimney and stacks.
- F. Install slip joints allowing removal of appliances without removal or dismantling of chimneys or stacks.

END OF SECTION

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SECTION 15720

INDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes modular factory fabricated air-handling units and accessories.

1.02 REFERENCES

- A. American Bearing Manufacturers Association:
1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
 2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- B. Air Movement and Control Association International, Inc.:
1. AMCA 99 - Standards Handbook.
 2. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
 3. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
 4. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
 5. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.
- C. Air-Conditioning and Refrigeration Institute:
1. ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.
 2. ARI 430 - Central-Station Air-Handling Units.
 3. ARI Guideline D - Application and Installation of Central Station Air-Handling Units.
- D. National Electrical Manufacturers Association:
1. NEMA MG 1 - Motors and Generators.

- E. Sheet Metal and Air Conditioning Contractors:
 - 1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
- F. Underwriters Laboratories Inc.:
 - 1. UL 900 - Air Filter Units.
 - 2. UL - Fire Resistance Directory.

1.03 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.
 - 1. Provide shop drawings and calculations for air handler equipment stand.
- C. Product Data, Submit the following:
 - 1. Published Literature: Indicate capacities, ratings, gages and finishes of materials, and electrical characteristics and connection requirements.
 - 2. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.
 - 3. Fans: Performance and fan curves with specified operating point plotted, power, RPM.
 - 4. Sound Power Level Data: Fan outlet and casing radiation at rated capacity.
 - 5. Dampers: Include leakage, pressure drop, and sample calibration curves. Indicate materials, construction, dimensions, and installation details.
 - 6. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring. Indicate factory installed and field installed wiring.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Product Requirements: Product storage and handling requirements.
- B. Accept units and components on site in factory protective containers, with factory shipping skids and lifting lugs. Inspect for damage.

- C. Protect units from weather and construction traffic by storing in dry, roofed location.

PART 2 - PRODUCTS

2.01 AIR HANDLING UNIT

- A. Configuration: Fan section plus accessories, including:
 - 1. Mixing Box
 - 2. Filter section.
 - 3. Oil Fired heater/blower assembly
- B. Fabrication: Conform to AMCA 99
- C. Casing: Minimum 1 inch double wall construction.
- D. Access: Side access panels to filters and fans units.
- E. Fan: Forward curved.
- F. Oil Fired Heating Section:
 - 1. Oil burner with induced draft fan.
 - 2. Modulated 10 to 1.
 - 3. Stainless steel heat exchanger.
- G. Isolation: Internal fan/motor isolation with neoprene isolators and flexible connection from fan to unit.
- H. Mixing Box with return and outside air control dampers.
 - 1. Actuators to be hard linked and provided with manual operators.
- I. Filter: 2 inch disposable filter, minimum MERV 8..
- J. Drain Pan: Double pitch, stainless steel.
- K. Filter Gauges: 3-1/2 inch diameter diaphragm actuated dial in metal case with static pressure tips.
- L. Stand: Provide shop or field fabricated metal stand to raise unit minimum of 18 inches above the floor.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in accordance with ARI 430.
- B. Install unit per manufacturer's instructions.
- C. Install flexible connections between unit and inlet and discharge ductwork. Install metal bands of connectors parallel with minimum 1 inch flex between ductwork and fan while running. Refer to Section 15820.
- D. Provide sheaves required for final air balance.

3.02 CLEANING

- A. Section 01700 - Execution Requirements: Requirements for cleaning.
- B. Install temporary filters during construction period. Replace with permanent filters at Substantial Completion.

3.03 PROTECTION OF FINISHED WORK

- A. Section 01700 - Execution Requirements: Requirements for protecting finished Work.
- B. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

SECTION 15810

DUCTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Duct Materials.
 2. Single wall spiral round ducts.
 3. Transverse duct connection system.
 4. Ductwork fabrication.

1.02 REFERENCES

- A. ASTM International:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
 2. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 3. ASTM A568/A568M - Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
 4. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 5. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 6. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 7. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

- B. National Fire Protection Association:
 - 1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
 - 2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
 - 3. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- C. Sheet Metal and Air Conditioning Contractors:
 - 1. SMACNA - HVAC Air Duct Leakage Test Manual.
 - 2. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
- D. Underwriters Laboratories Inc.:
 - 1. UL 181 - Factory-Made Air Ducts and Connectors.

1.03 PERFORMANCE REQUIREMENTS

- A. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.04 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Section 01600 - Product Requirements.
- B. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.
- C. Maintain temperatures during and after installation of duct sealant.

1.06 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.01 DUCT MATERIALS

- A. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having zinc coating of in conformance with ASTM A90/A90M.
- B. Fasteners: Rivets, bolts, or sheet metal screws.
- C. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.02 SINGLE WALL SPIRAL ROUND DUCTS

- A. Product Description: UL 181, Class 1, round spiral lock seam duct constructed of galvanized steel.
- B. Construct duct gauges to 4 inches positive pressure.

2.03 TRANSVERSE DUCT CONNECTION SYSTEM

- A. Manufacturers: Ductmate
- B. Product Description: SMACNA "E", "F", or "J" rated rigidity class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

2.04 DUCTWORK FABRICATION

- A. Fabricate and support rectangular ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and as indicated on Drawings. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Fabricate and support round ducts with longitudinal seams in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible (Round Duct Construction Standards), and as indicated on Drawings. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- C. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide turning vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation unless otherwise noted.

- D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- E. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.
- F. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify sizes of equipment connections before fabricating transitions.

3.02 INSTALLATION

- A. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible. Sealant to be mastic, applied with brush. Seal all joints including longitudinal joints.
- B. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- C. Use crimp joints with or without bead or beaded sleeve couplings for joining round duct sizes 8 inch and smaller.
- D. Install duct hangers and supports in accordance with Section 15060.
- E. Use double nuts and lock washers on threaded rod supports.

3.03 INTERFACE WITH OTHER PRODUCTS

- A. Install openings in ductwork where required to accommodate thermometers and controllers. Install pitot tube openings for testing of systems. Install pitot tube complete with metal can with spring device or screw to prevent air leakage. Where openings are provided in insulated ductwork, install insulation material inside metal ring.
- B. Connect air outlets and inlets to low pressure ducts directly.
- C. Provide duct access doors at fire damper locations. Size and location shall be such that the fire damper linkage can be replaced and the damper reset.

END OF SECTION

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SECTION 15820
DUCT ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Counter Balanced Back-draft dampers.
 2. Duct access doors.
 3. Static fire dampers.
 4. Volume control dampers.
 5. Flexible duct connections.
 6. Duct test holes.
 7. Dial thermometers.
 8. Static pressure gages.

1.02 REFERENCES

- A. Air Movement and Control Association International, Inc.:
1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.
- B. ASTM International:
1. ASTM E1 - Standard Specification for ASTM Thermometers.
- C. National Fire Protection Association:
1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
 2. NFPA 92A - Recommended Practice for Smoke-Control Systems.
- D. Sheet Metal and Air Conditioning Contractors:
1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

- E. Underwriters Laboratories Inc.:
 - 1. UL 555 - Standard for Safety for Fire Dampers.

1.03 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data for shop fabricated assemblies and hardware used.
- C. Product Data: Submit for the following. Include where applicable electrical characteristics and connection requirements.
 - 1. Fire dampers including locations and ratings.
 - 2. Backdraft dampers.
 - 3. Flexible duct connections.
 - 4. Volume control dampers.
 - 5. Duct access doors.
- D. Product Data: For fire dampers, submit the following:
 - 1. Include UL ratings, dynamic ratings, leakage, pressure drop and maximum pressure data.
 - 2. Indicate materials, construction, dimensions, and installation details.
 - 3. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

1.04 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.01 COUNTER BALANCED BACK-DRAFT DAMPERS

- A. Product Description: Multi-Blade, back-draft dampers: Parallel-action, gravity-balanced, Galvanized 16 gage thick steel, or extruded aluminum. Blades, maximum 6 inch width, with felt or flexible vinyl sealed edges. Blades linked together in rattle-free manner with 90-degree stop, steel ball bearings, and plated steel pivot pin. Furnish dampers with adjustment device to permit setting for varying differential static pressure.

2.02 DUCT ACCESS DOORS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, furnish minimum 1 inch thick insulation with sheet metal cover.
 - 1. Access panels with sheet metal screw fasteners are not acceptable.

2.03 STATIC FIRE DAMPERS

- A. Fire Rating: UL 555 classified and labeled as a 1-1/2 hour static fire damper.
- B. Air Flow Rating: UL approved for dual directional air flow.
- C. Integral Sleeve Frame: Minimum 20 gage by 12 inches roll formed, galvanized steel.
 - 1. Factory Sealant: Apply to dampers in HVAC systems with pressures to maximum 4 inches wg.
- D. Blades:
 - 1. Style: Curtain type, in airstream.
 - 2. Action: Spring or gravity closure upon fusible link release.
 - 3. Orientation: Horizontal.
 - 4. Material: Minimum 24 gage roll formed, galvanized steel.
- E. Closure Springs: Type 301 stainless steel, constant force tye, if required.
- F. Finish: Mill galvanized.

2.04 VOLUME CONTROL DAMPERS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. Splitter Dampers:
 - 1. Material: Same gage as duct to 24 inches size in both dimensions, and two gages heavier for sizes over 24 inches.

2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
 3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw;
 4. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.
 5. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized frame channel with suitable hardware;
 6. End Bearings: Except in round ductwork 12 inches and smaller, furnish end bearings. On multiple blade dampers, furnish oil-impregnated nylon or sintered bronze bearings. Furnish closed end bearings on ducts having pressure classification over 2 inches wg.
- C. Quadrants:
1. Furnish locking, indicating quadrant regulators on single and multi-blade dampers.
 2. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases, or adapters.
 3. Where rod lengths exceed 30 inches furnish regulator at both ends.

2.05 FLEXIBLE DUCT CONNECTIONS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible,.
- B. Connector: Fabric crimped into metal edging strip.
 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric conforming to NFPA 90A, minimum density 30 oz per sq yd.
 2. Net Fabric Width: Approximately 3 inches wide.

2.06 DUCT TEST HOLES

- A. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Furnish extended neck fittings to clear insulation.

2.07 DIAL THERMOMETERS

- A. Thermometer: ASTM E1, stainless steel case, adjustable angle with front calibration, bimetallic helix actuated with silicone fluid damping, white with black markings and black pointer hermetically sealed lens, stainless steel stem.
 - 1. Size: 3 inch diameter dial.
 - 2. Lens: Clear glass or Lexan.
 - 3. Accuracy: 1 percent.
 - 4. Calibration: Degrees F.

2.08 STATIC PRESSURE GAGES

- A. Dial Gages: 3-1/2 inch diameter dial in metal case, diaphragm actuated, black figures on white background, front calibration adjustment, 2 percent of full scale accuracy.
- B. Inclined Manometer: Plastic with red liquid on white background with black figures, front calibration adjustment, 3 percent of full scale accuracy.
- C. Accessories: Static pressure tips with compression fittings for bulkhead mounting, 1/4 inch diameter tubing.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify rated walls are ready for fire damper installation.
- C. Verify ducts and equipment installation are ready for accessories.
- D. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.02 INSTALLATION.

- A. Install in accordance with NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 15810 for duct construction and pressure class.
- B. Install back-draft dampers on exhaust fans or exhaust ducts nearest to outside.

- C. Install Access Doors at Fire Dampers and as indicated: Install minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access. Size must allow replacement of fire damper linkages and resetting of damper. Review locations prior to fabrication.
- D. Install temporary duct test holes and required for testing and balancing purposes. Cut or drill in ducts. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- E. Install fire dampers at locations as indicated on Drawings. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
 - 1. Install dampers square and free from racking with blades running horizontally.
 - 2. Do not compress or stretch damper frame into duct or opening.
 - 3. Handle damper using sleeve or frame. Do not lift damper using blades, actuator, or jack shaft.
 - 4. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.

3.03 INSTALLATION - THERMOMETERS

- A. Install thermometers in air duct systems on flanges.
- B. Where thermometers are provided on local panels, duct mounted thermometers are not required.
- C. Locate duct-mounted thermometers minimum 10 feet downstream of mixing-dampers, coils, or other devices causing air turbulence.
- D. Install static pressure gages to measure across filters and filter banks, (inlet to outlet). On multiple banks, provide manifold and single gage.
- E. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- F. Install thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- G. Adjust thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.04 DEMONSTRATION

- A. Section 01700 - Execution Requirements for demonstration and training.
- B. Demonstrate re-setting of fire dampers to Department's representative.

END OF SECTION

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SECTION 15830

FANS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Cabinet fans.
 - 2. Ceiling fans.
 - 3. Kitchen range hood.

1.02 REFERENCES

- A. American Bearing Manufacturers Association:
 - 1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
 - 2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- B. Air Movement and Control Association International, Inc.:
 - 1. AMCA 99 - Standards Handbook.
 - 2. AMCA 204 - Balance Quality and Vibration Levels for Fans.
 - 3. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
 - 4. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
 - 5. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- C. National Electrical Manufacturers Association:
 - 1. NEMA MG 1 - Motors and Generators.
 - 2. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.03 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data on each type of fan and include accessories, fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, electrical characteristics and connection requirements.

1.04 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.01 CABINET FANS

- A. Centrifugal Fan Unit: Direct driven with galvanized steel housing lined with 1/2 inch acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge opening, integral outlet duct collar.
- B. Disconnect Switch: Cord and plug in housing for thermal overload protected motor.
- C. Grille: Molded white plastic or aluminum.
- D. Motor: Open drip proof type with permanently lubricated sealed bearings and thermal overload protection.
- E. Accessories:
 - 1. Fan speed controller.
 - 2. Radiation damper.

2.02 CEILING FANS

- A. Manufacturers: Big Ass Fans or pre-approved equal.
- B. Airfoils: Ten TEC airfoils with winglets.
 - 1. Color: Per Architect.
- C. Motor: Gearless directdrive, fully adjustable.
- D. Sound level: <40 dBA

- E. Accessories:
 - 1. LCD wall controller.

2.03 KITCHEN HOOD

- A. 30 inch wide, vented range exhaust hood with cooktop light, removable grease filter, and backdraft damper.
- B. Exhaust connection to be convertible from 3-1/4"x10" to 7" diameter.
- C. Color: White.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.

3.02 INSTALLATION

- A. Hard connect all fans.
- B. Install safety screen where inlet or outlet is exposed.
- C. Install backdraft dampers on discharge of exhaust fans

3.03 PROTECTION OF FINISHED WORK

- A. Section 01700 - Execution Requirements: Requirements for protecting finished Work.
- B. Do not operate fans for until ductwork is clean, bearings lubricated, and fan has been test run under observation.

END OF SECTION

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SECTION 15850

AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Diffusers.
 - 2. Registers
 - 3. Grilles.
 - 4. Louvers.

1.02 REFERENCES

- A. Air Movement and Control Association International, Inc.:
 - 1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets.
- C. Sheet Metal and Air Conditioning Contractors:
 - 1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.03 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit sizes, finish, and type of mounting. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

PART 2 - PRODUCTS

2.01 WALL SUPPLY REGISTERS/GRILLES

- A. Type: Streamlined and individually adjustable blades, 3/4 inch maximum spacing with spring or other device to set blades, horizontal face, double deflection.

- B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.
- C. Fabrication: Steel with 20 gage minimum frames and 22 gage minimum blades, steel and aluminum with 20 gage minimum frame, or aluminum extrusions, with factory white finish.

2.02 WALL SUPPLY AEROBLADE GRILLES

- A. Type: Streamlined and individually adjustable blades, 3/4 inch maximum spacing with spring or other device to set blades, vertical face, single deflection.
- B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.
- C. Fabrication: Steel with 20 gage minimum frames and 22 gage minimum extruded aluminum blades, steel and aluminum with 20 gage minimum frame, or aluminum extrusions, with factory white finish.

2.03 LINEAR FLOOR SUPPLY REGISTERS/GRILLES

- A. Type: Streamlined blades with 30degree deflection, 1/8 x 3/4 inch on 7/16 inch centers.
- B. Frame: 1-1/4 heavy margin frame with exposed countersunk screw mounting. Provide heavy duty core.
- C. Fabrication: Aluminum extrusions with factory clear anodized finish.

2.04 RETURN AND RELIEF REGISTERS/GRILLES

- A. Type: Heavy duty bar return grille with 1/2 " blade spacing with blades set at 38 degrees, horizontal face.
- B. Frame: 1-1/4 inch margin with countersunk screw mounting.
- C. Fabrication: Steel with 16 gage border, 14 gauge steel blades, support bars 6 inches on center. White factory finish.

2.05 LOUVERS

- A. Ruskin Manufacturing Model ELF 6375 DX
- B. Product Description: Stationary.
- C. Type: 6 inch deep with blades on 45 degree slope, heavy channel frame.
- D. Fabrication: 12 gage thick extruded aluminum, welded assembly, with following specified finish:

1. High-Performance Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Color as selected by Architect from manufacturer's standard factory colors.
- E. Bird Screen: Bird screen with 1 inch square mesh.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify inlet and outlet locations.
- C. Verify finishes and systems are ready for installation.

3.02 INSTALLATION

- A. Install diffusers to ductwork with airtight connection.
- B. Install balancing dampers on duct take-off to diffusers, grilles, and registers, whether or not dampers are furnished as part of diffuser, grille, and register assembly. Refer to Section 15820.

3.03 INTERFACE WITH OTHER PRODUCTS

- A. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

END OF SECTION

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SECTION 15940 - SEQUENCE OF OPERATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes sequence of operation for:

1. Space heating.
 - a. Space heaters
2. Ventilation.
 - a. Air handling units.
 - b. Toilet exhaust fans
 - c. Supply fans
 - d. Ceiling fan
3. Plumbing.
 - a. Well pump
 - b. Pressure pump
 - c. Hot water circulation pump
 - d. Water heater

- 4. Fuel Oil.
 - a. Fuel transfer pump

B. Related Sections:

- 1. Section 15010 – General Mechanical Conditions
- 2. Section 15050 – Basic Mechanical Materials and Methods

C. See drawings and Division 1 for extent of contract work.

1.02 SUBMITTALS

A. Submit under the provisions of Division 1, Section 15010, and Section 15910.

1.03 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance data under the provisions of Division 1, Section 15010, and Section 15910.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.01 SPACE HEATING:

- A. Space Heaters, SH-1:
 - 1. Operation controlled by integral unit controller. Initially program set point temperature to 68 degrees Fahrenheit. Install fuel lift pump per manufacturer's instructions.

3.02 VENTILATION

A. Air Handling Unit, AHU-1

1. AHU-1 shall operate in on or off mode of operation controlled by main disconnect switch located in the mechanical room.

a. On Mode of Operation

- 1) Fan shall operate continuously. The fan shall be balanced so the design CFM is achieved with the outside air damper positioned for 20% outside air.
- 2) Outside air damper shall be manually controlled and interlocked with the return air damper such that when outside air damper is full closed the return air damper shall be full open. Provide adjustable setscrew or similar to initially limit the maximum outside air position to 20%. Provide indication on damper actuator of reading "Percent Outside Air" with scale ranging from 0 percent outside air to 100% outside air.
- 3) The fuel oil burner shall modulate firing rate through integral unit controls to achieve 68 degree Fahrenheit supply air temperature (adjustable).

b. Off Mode of Operation

- 1) Fan shall be off.
- 2) Manually close the outside air damper.
- 3) Fuel burner is off.

- B. Toilet Room Exhaust, TEF-1
 - 1. TEF-1 shall operate in an on or off mode. Operation interlocked with the local light switch.

- C. Supply fan, SF-1
 - 1. SF-1 shall operate in an on or off mode. Operation interlocked with the local light switch serving the room where the fan is located.

- D. Ceiling fan, CF-1
 - 1. CF-1 shall be controlled by LCD unit controller provided by manufacturer. Mount controller in mechanical room.

3.03 PLUMBING

- A. Well pump (designed by others)
 - 1. Pump shall be controlled by a wall switch located in the mechanical room. When facility is in use the switch shall manually be placed in the energized position. A high level float switches in the water holding tank, WT-1, shall control the well pump operation through a relay connected to the wall switch. When the float switch is in the down position the well pump shall be energized, when the float switch is in the up position the well pump shall be de-energized.

- B. Pressure pump, PP-1
 - 1. Pump shall be controlled by a wall switch located in the mechanical room and shared with the well pump. When facility is in use the switch shall manually be placed in the energized position. A low level float switch in the water holding tank, WT-1, shall control the pressure pump operation through a relay connected to the wall switch. When the float switch is in the up position power shall be provided the pressure pump. A pressure

sensor located near the pressure pump and installed to sense domestic water pressure shall be the basis of the turning the pump on and off to achieve desired system pressure. Initially set the pressure sensor to 50 psig. When the low level float switch is in the down position the power to the pressure pump shall be interrupted to prevent burning the motor out.

C. Hot water circulation pump, CP-1

1. Pump shall operate on an on or off basis. A wall switch located in the mechanical room shall control the operation of CP-1. When the facility is occupied the switch shall be energized and the pump shall operate continuously. When the facility is unoccupied the wall switch shall be deactivated and the pump shall be off.

D. Water Heater, WH-1

1. Water heater operation shall be controlled by on board electronics and aquastat. Initially program the water heater to provide 120 degree Fahrenheit storage temperature. Provide manual switch to interrupt power supply to water heater for periods where the facility is unoccupied.

3.04 FUEL OIL

A. Fuel Transfer Pump Set, FTP-1

1. Pump shall operate continuously when facility is in use. Pump shall be manually deactivated when facility is not in use. Pump set shall have manual switching capability such that pump operation can be alternated on a monthly basis and for maintenance.

END OF SECTION 15940

SECTION 15950

TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Testing adjusting and balancing of air systems.
 - 2. Measurement of final operating condition of HVAC systems.
 - 3. Sound measurement of equipment operating conditions.
 - 4. Vibration measurement of equipment operating conditions.

1.02 REFERENCES

- A. Associated Air Balance Council:
 - 1. AABC MN-1 - National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems.
- C. Natural Environmental Balancing Bureau:
 - 1. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

1.03 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Prior to commencing Work, submit proof of latest calibration date of each instrument.
- C. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

- D. Submit draft copies of report for review prior to final acceptance of Project.
- E. 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.

1.04 QUALIFICATIONS

- A. Agency: Company specializing in testing, adjusting, and balancing of systems specified in this section with minimum three years documented experience and certified by either AABC or NEBB.

1.05 SEQUENCING

- A. Section 01100 - Summary: Work sequence.
- B. Sequence balancing between completion of systems tested and Date of Substantial Completion.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. 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. Duct systems are clean of debris.
 - 6. Fans are rotating correctly.

7. Fire and volume dampers are in place and open.
8. Access doors are closed and duct end caps are in place.
9. Air outlets are installed and connected.
10. Duct system leakage is minimized.
11. Pumps are rotating correctly.
12. Proper strainer baskets are clean and in place or in normal position.
13. Service and balancing valves are open.

3.02 PREPARATION

- A. Furnish instruments required for testing, adjusting, and balancing operations.
- B. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

3.03 INSTALLATION TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 10 percent of design.
- B. 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.
- C. Water Systems: Adjust to within plus or minus 10 percent of design.

3.04 ADJUSTING

- A. Section 01700 - Execution Requirements: Testing, adjusting, and balancing.
- B. Verify recorded data represents actual measured or observed conditions.
- C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.
- E. Report defects and deficiencies noted during performance of services, preventing system balance.

- F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Department.
- H. Check and adjust systems approximately six months after final acceptance and submit report.

3.05 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to obtain required or design supply, return, and exhaust air quantities.
- B. Make air quantity measurements in main ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts.
- E. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.
- F. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.
- G. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Make allowances for 50 percent loading of filters.
- H. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- I. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- J. At modulating damper locations, take measurements and balance at extreme conditions. Balance variable volume systems at maximum airflow rate, full cooling, and at minimum airflow rate, full heating.

- K. Measure building static pressure and adjust supply, return, and relief air counter-balanced backdraft damper to obtain required relationship between each to maintain approximately 0.05 inches positive static pressure near building entries.

3.06 WATER SYSTEM PROCEDURE

- A. Adjust water systems, after air balancing, to obtain design quantities.
- B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow-metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in system.
- C. Adjust systems to obtain specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- D. Effect system balance with automatic control valves fully open or in normal position to heat transfer elements.
- E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
- F. Where available pump capacity is less than total flow requirements or individual system parts, simulate full flow in one part by temporary restriction of flow to other parts.

3.07 SCHEDULES

- A. Equipment Requiring Testing, Adjusting, and Balancing:
 - 1. Water Pumps.
 - 2. Air Handling Units.
 - 3. Fans.
 - 4. Air Filters.
 - 5. Air Inlets and Outlets.

B. Report Forms

1. Title Page:

- a. Name of Testing, Adjusting, and Balancing Agency
- b. Address of Testing, Adjusting, and Balancing Agency
- c. Telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency
- d. Project name
- e. Project location
- f. Project Architect
- g. Project Engineer
- h. Project Contractor
- i. Project altitude
- j. Report date

2. Summary Comments:

- a. Design versus final performance
- b. Notable characteristics of system
- c. Description of systems operation sequence
- d. Summary of outdoor and exhaust flows to indicate building pressurization
- e. Nomenclature used throughout report
- f. Test conditions

3. Instrument List:

- a. Instrument
- b. Manufacturer
- c. Model number

- d. Serial number
- e. Range
- f. Calibration date

4. Electric Motors:

- a. Manufacturer
- b. Model/Frame
- c. HP/BHP and kW
- d. Phase, voltage, amperage; nameplate, actual, no load
- e. RPM
- f. Service factor
- g. Starter size, rating, heater elements
- h. Sheave Make/Size/Bore

5. V-Belt Drive:

- a. Identification/location
- b. Required driven RPM
- c. Driven sheave, diameter and RPM
- d. Belt, size and quantity
- e. Motor sheave diameter and RPM
- f. Center to center distance, maximum, minimum, and actual

6. Pump Data:

- a. Identification/number
- b. Manufacturer
- c. Size/model
- d. Impeller

- e. Service
- f. Design flow rate, pressure drop, BHP and kW
- g. Actual flow rate, pressure drop, BHP and kW
- h. Discharge pressure
- i. Suction pressure
- j. Total operating head pressure
- k. Shut off, discharge and suction pressures
- l. Shut off, total head pressure

7. Combustion Test:

- a. Manufacturer
- b. Model number
- c. Serial number
- d. Firing rate
- e. Overfire draft
- f. Burner manifold gas pressure
- g. Percent carbon monoxide (CO)
- h. Percent carbon dioxide (CO₂)
- i. Percent oxygen (O₂)
- j. Percent excess air
- k. Flue gas temperature at outlet
- l. Ambient temperature
- m. Net stack temperature
- n. Percent stack loss

- o. Percent combustion efficiency
- p. Heat output

8. Air Moving Equipment:

- a. Location
- b. Manufacturer
- c. Model number
- d. Serial number
- e. Arrangement/Class/Discharge
- f. Air flow, specified and actual
- g. Return air flow, specified and actual
- h. Outside air flow, specified and actual
- i. Total static pressure (total external), specified and actual
- j. Inlet pressure
- k. Discharge pressure
- l. Sheave Make/Size/Bore
- m. Number of Belts/Make/Size
- n. Fan RPM

9. Return Air/Outside Air Data:

- a. Identification/location
- b. Design air flow
- c. Actual air flow
- d. Design return air flow
- e. Actual return air flow
- f. Design outside air flow

- g. Actual outside air flow
 - h. Return air temperature
 - i. Outside air temperature
 - j. Required mixed air temperature
 - k. Actual mixed air temperature
 - l. Design outside/return air ratio
 - m. Actual outside/return air ratio
10. Exhaust Fan Data:
- a. Location
 - b. Manufacturer
 - c. Model number
 - d. Serial number
 - e. Air flow, specified and actual
 - f. Total static pressure (total external), specified and actual
 - g. Inlet pressure
 - h. Discharge pressure
 - i. Sheave Make/Size/Bore
 - j. Number of Belts/Make/Size
 - k. Fan RPM
11. Duct Traverse:
- a. System zone/branch
 - b. Duct size
 - c. Area
 - d. Design velocity

- e. Design air flow
 - f. Test velocity
 - g. Test air flow
 - h. Duct static pressure
 - i. Air temperature
 - j. Air correction factor
12. Air Distribution Test Sheet:
- a. Air terminal number
 - b. Room number/location
 - c. Terminal type
 - d. Terminal size
 - e. Area factor
 - f. Design velocity
 - g. Design air flow
 - h. Test (final) velocity
 - i. Test (final) air flow
 - j. Percent of design air flow

END OF SECTION

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SECTION 16010
BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Basic Electrical Requirements specifically applicable to Division 16 Sections, in addition to Division 1 – General Requirements.

1.02 RELATED SECTIONS

- A. Division 1 – General Requirements.
- B. Section 13851 – Fire Alarm Systems.
- C. Section 16060 – Grounding and Bonding.
- D. Section 16070 – Hangers and Supports.
- E. Section 16075 – Electrical Identification.
- F. Section 16123 – Building Wire and Cable.
- G. Section 16130 – Raceway and Boxes.
- H. Section 16140 – Wiring Devices.
- I. Section 16235 – Engine Generators.
- J. Section 16411 – Enclosed Switches.
- K. Section 16421 – Enclosed Controllers.
- L. Section 16442 – Panelboards.
- M. Section 16510 – Light Fixtures.

1.03 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI C80.1-1994 – Rigid Steel Conduit, Zinc Coated, Specification for.
 - 2. ANSI C80.3-1994 – Electrical Metallic Tubing, Zinc Coated, Specification for.
- B. International Building Code: IBC, latest adopted edition.
- C. Institute of Electrical and Electronics Engineers: IEEE 142-1992 – Recommended Practice for Grounding of Industrial and Commercial Power Systems.
- D. Illuminating Engineering Society: IESNA Lighting Handbook – Reference and Application.

- E. National Electrical Manufacturers Association:
 - 1. NEMA 250-2003 – Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2. NEMA AB 1-2002 – Molded-Case Circuit Breakers, Molded Case Switches, and Circuit Breaker Enclosures.
 - 3. NEMA FB 1-2003 – Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable Assemblies.
 - 4. NEMA ICS 2 – Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.
 - 5. NEMA ICS 4-2005 – Terminal Blocks.
 - 6. NEMA ICS 6-1993 (R2001) – Industrial Control and Systems Enclosures.
 - 7. NEMA KS 1 – Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
 - 8. NEMA OS 1-2002 – Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 9. NEMA PB 1-2000 – Panelboards.
 - 10. NEMA PB1.1-2002 – General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.
 - 11. NEMA WD 1-1999 – General Color Requirements for Wiring Devices.
 - 12. NEMA WD 6-2002 – Wiring Devices Dimensional Requirements.
- F. National Fire Protection Association:
 - 1. NFPA 70 – National Electrical Code, latest adopted edition.
 - 2. NFPA 72 – National Fire Alarm Code, latest adopted edition.
 - 3. NFPA 101 – Life Safety Code, latest adopted edition.

1.04 REGULATORY REQUIREMENTS

- A. Conform to International Building Code latest adopted edition.
- B. Electrical: Conform to NFPA 70, latest adopted edition.
- C. Furnish products listed and classified by Underwriters Laboratories, Inc. or an independent testing firm acceptable to the authority having jurisdiction as suitable for purpose specified and shown.

1.05 SUBMITTALS AND APPROVALS

- A. Submit under provisions of Division 1 and Division 16.

- B. Proposed Products List: Provide products specified in the individual Sections that follow.
- C. Prior to the purchase or ordering of any materials or equipment, submit for approval complete data describing all items intended for use in the Work. Include the item's manufacturer, identifying number or nomenclature, and other information as necessary to describe the item. Include the manufacturer's published data describing each item's size, capacity, performance, and power requirements. The number of copies to be submitted and the number of copies returned with actions noted is as specified in the General and/or Special Conditions. Provide certification stating that the material has been reviewed by the Contractor and that all items conform with the Contract requirements. Submittals made without such certification will be returned unreviewed. This certification shall be in the form of a stamp on each material item submitted and signed or initialed. The name of the certifier shall be typed or legibly printed in or near the stamp.
- D. At the Department's and Architect/Engineer's option, partial submittals which encompass less than a single section will be returned unreviewed or held unreviewed until the submittal is complete.
- E. When substitute equipment is proposed, clearly and unambiguously mark submitted material describing the substitute to identify the differences between the qualities and characteristics of the offered substitute and the specified material. Failure to provide this identification of differences when substitutes are submitted for consideration may result in rejection of the proposed material.
- F. When equipment substitutions are approved and that equipment alters the design or space requirements indicated on the plans, pay for all items of cost for the revised design and construction including costs of other trades involved and any engineering required to incorporate the approved substituted equipment into the Project. The Contractor shall pay for the required additional costs.
- G. Material and equipment installed, purchased, furnished, or provided for the Project that has not been submitted and reviewed by the Department may be ordered removed and acceptable material and equipment installed in its place at no additional cost to the Department.
- H. Pay the Department's complete costs, including the services of technical, professional, and other staff employed by or functioning at the Department's request under other contracts with the Department, for review of submittals due to the failure to submit materials which comply with the provisions of the Contract Documents within two submittals for each equipment type or item. Reviews in addition to the initially submitted material and one subsequent review of resubmitted material shall be paid for by the Contractor.

- I. Shop and coordination Drawings shall include site plans, grid lines, grid bubbles, and all other reference lines and symbols equal to the Design Drawings.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. All material shall be new, unused, and delivered to the job site packed in their original containers.
- B. All material shall be delivered free of damage or defects.
- C. Provide adequate storage facilities at the Project Site or other approved location to protect materials from damage or corrosion. Coordinate with other trades to limit storage to designated areas as approved by the Department.
- D. Protect material, equipment, and apparatus provided under this Division from damage, water, and dust, both in storage and after installation, until Notice of Completion has been filed. Materials, equipment, or apparatus damaged because of improper storage or protection will be rejected and must be removed from the site.

1.07 PROJECT/SITE CONDITIONS

- A. Provide Work in locations shown on Drawings, unless prevented by Project conditions.
- B. Prepare and submit shop and coordination drawings showing proposed arrangement of Work coordinated with all other trades and work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Department before proceeding.

1.08 DRAWINGS

- A. Drawings are diagrammatic and not intended to show exact details.
- B. Field verify all scales and dimensions shown on the plans. Final locations, distances, and levels shall be governed by actual field conditions.
- C. Review and coordinate this Work with architectural, structural, plumbing, heating, ventilating, and all other Drawings and Specifications and adjust this Work as required to be compatible with all conditions indicated.
- D. The Drawings show the general locations of the electrical features only except for features specifically dimensioned. When necessary to present a symmetrical appearance or to avoid interference with other installations, make minor relocations as required. The Drawings and Specifications are complementary to each other. What is shown on one is binding as if called for in both.
- E. Promptly bring to the attention of the Department for a decision, discrepancies among different Drawings or between Drawings and actual field conditions or Specifications.

1.09 DEFINITIONS

- A. Department - Owner or its Authorized Representative.
- B. Furnish - Means purchase and bring to the Job Site.
- C. Install - Means incorporate into the Work, including connections and make operational.
- D. Provide - Means furnish, install, connect, and make operational.
- E. Work or Project - Shall mean all Work required by the Contract Agreement.
- F. "All" and "Typical" are implied throughout the Specifications and Drawings and are not repeated in every instance.

PART 2 - PRODUCTS

- 2.01** Provide materials and equipment of major and reputable manufacturers with ability to render competent and thorough service through local organizations capable of expeditiously providing service, parts, and assistance. All products provided in this Project shall have at least one representative authorized by the manufacturer of the product permanently based within the State of Alaska, or the manufacturer shall certify that service of his product is available within 24 hours at the Project Site after initial request for service.
- 2.02** In addition to specified material and equipment, provide all incidental materials required to provide complete installation. Such incidental materials include but are not limited to solders, tapes, caulking, mastics, gaskets, and other appurtenances as required.
- 2.03** Materials of similar nature, style, function, purpose and/or appearance shall be like products from the standard product line of the same manufacturer. All products shall be the standard catalog item successfully furnished and used by the manufacturer for a minimum of three years prior to bid opening. The manufacturer shall have been engaged in the assembly, fabrication, and supply of similar equipment or materials for a minimum of five years.
- 2.04** Provide products listed by Underwriters' Laboratories for their intended use and location in all cases where UL lists such products. Where no product listed by UL for the application is available, provide certification of performance, function, and rating from an independent testing agency or laboratory approved by the Authority having jurisdiction.
- 2.05** Equipment shall be installed using the accessories available from the equipment manufacturer for the application with the selected accessories with the submittal data. Where accessories are not available from the manufacturer and other accessories are proposed for use, submit all proposed installation accessories with equipment submittal. Indicate mounting arrangements using drawings and descriptions. Equipment and proposed accessories shall be listed or independently certified (in accordance with previous paragraph) suitable for the application when completely installed.

- 2.06** Provide materials and equipment suitable for operation throughout the range of temperatures and other ambient conditions likely to be encountered. Provide components of equipment, including but not limited to, construction materials, supports, hangers, insulation, lubricants, pulling compounds, sealing mixtures, finishes, electrical and electronic components suitable for the anticipated operating ambient temperature range. Do not store, install, test, operate, or transport any material, component or equipment at any temperature that results in damage, shortened useful life, or reduced reliability.

PART 3 - EXECUTION

3.01 CLEANING

- A. Clear away all debris, surplus materials, etc., resulting from this Work and operations, leaving the entire Project and all equipment in a clean, functional, and first-class condition.
- B. Exterior surfaces of all electrical equipment enclosures shall be wiped or vacuum-cleaned to remove construction debris and dust.
- C. Interiors of all electrical equipment enclosures, fixtures, closets, etc., shall be cleaned to remove construction debris and dust.
- D. Vacuum-clean accessible elements of disconnecting and protective devices of equipment and the like prior to energizing.
- E. All materials, enclosures, interiors of enclosures, and all other surfaces shall be left dry and show no evidence of water marks, staining, or rust.
- F. Clean all surfaces including but not limited to lamps, trims, reflectors, louvers, refractors, lenses, device plates, etc. Remove all fingerprints, temporary labels, etc. from surfaces of all lighting fixtures, equipment, enclosures, building elements, etc.

END OF SECTION

SECTION 16060
GROUNDING AND BONDING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Grounding electrodes and conductors.
- B. Equipment grounding conductors.
- C. Bonding.

1.02 RELATED SECTIONS

- A. Division 1 – General Requirements.
- B. Section 13851 – Fire Alarm Systems.
- C. Sections 16010 – Basic Electrical Requirements.
- D. Section 16075 – Electrical Identification.
- E. Section 16123 – Building Wire and Cable.
- F. Section 16130 – Raceway and Boxes.
- G. Section 16140 – Wiring Devices.
- H. Section 16235 – Engine Generators.
- I. Section 16411 – Enclosed Switches.
- J. Section 16421 – Enclosed Controllers.
- K. Section 16442 – Panelboards.
- L. Section 16510 – Light Fixtures.

1.03 REFERENCES

- A. Institute of Electrical and Electronics Engineers:
 - 1. IEEE 142 – Recommended Practice for Grounding of Industrial and Commercial Power Systems.
- B. National Electrical Contractors Association:
 - 1. NECA 1 – Standard Practice for Good Workmanship in Electrical Contracting.
- C. International Electrical Testing Association:
 - 1. NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems, latest published edition.
- D. National Fire Protection Association:

1. NFPA 70 – National Electrical Code, latest adopted edition.

1.04 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70, latest adopted edition.
- B. Provide products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.05 QUALIFICATIONS

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

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with NECA 1 - Standard Practice for Good Workmanship in Electrical Contracting.

1.07 SUBMITTALS

- A. Submit under provisions of Division 1 and Division 16.
- B. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

1.08 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1 and Division 16.
- B. Accurately record actual locations of all grounding electrodes and connections to equipment and building steel on as-built Drawings.

1.09 PROJECT CONDITIONS

- A. Verify locations of all grounding electrodes and connections prior to rough-in.
- B. Grounding electrodes and connections are shown schematically in approximate locations unless dimensioned. Provide at location required to serve intended purpose.

1.10 DESIGN REQUIREMENTS

- A. Grounding locations and installation: NFPA 70.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Division 1 and Division 16.
- B. Accept equipment on site. Inspect for damage.
- C. Protect equipment from corrosion and damage by storing above grade. Provide appropriate covering.

1.12 COORDINATION

- A. Coordinate Work under provisions of Division 1 and Division 16.

- B. Determine and maintain required separation between grounding conductors and other work.
- C. Determine and provide grounding locations to avoid interference with other work.

1.13 GROUNDING ELECTRODE SYSTEM

- A. Metal underground water pipe.
- B. Concrete piles, where available on premises.
- C. Steel Piles, where available on premises.
- D. Rod electrode.

1.14 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: 25 ohms.

PART 2 - PRODUCTS

2.01 ROD ELECTRODE

- A. Material: Copper-clad steel.
- B. Diameter: 3/4 inch.
- C. Length: 10 feet, minimum.

2.02 MECHANICAL CONNECTORS

- A. Material: Bronze.
 - 1. Ground Rod: Bolt-on clamp type
 - 2. Grounding Electrode Conductor Tap: Exothermic weld or irreversible splice.

2.03 WIRE

- A. Material: Stranded copper.
- B. Foundation Electrodes: Minimum 2 AWG.
- C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine products and verify project conditions under provisions of Division 1 and Division 16.
- B. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.02 INSTALLATION

- A. Provide products in accordance with manufacturer's instructions.

- B. Provide rod electrodes at locations indicated. Provide additional rod electrodes as required to achieve specified resistance to ground.
- C. Provide bonding to meet Regulatory Requirements.
- D. Bond together metal siding not attached to grounded structure; bond to ground.
- E. Equipment Grounding Conductor: Provide separate, insulated conductor within every feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- F. Grounding Electrode Conductor: Taps to the grounding electrode conductor shall be made with irreversible splices connections.

3.03 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
- B. Perform overall grounding system test using "Fall-of-Potential" method.
- C. Use suitable test instrument to measure grounding electrode system resistance to ground. Perform testing in accordance with test instrument manufacturer's instructions.

END OF SECTION

SECTION 16070
HANGERS AND SUPPORTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Conduit and equipment supports.
- B. Anchors and fasteners.

1.02 RELATED SECTIONS

- A. Division 1 – General Requirements.
- B. Section 13851 – Fire Alarm Systems.
- C. Sections 16010 – Basic Electrical Requirements.
- D. Section 16130 – Raceway and Boxes.
- E. Section 16235 – Engine Generators.
- F. Section 16411 – Enclosed Switches.
- G. Section 16421 – Enclosed Controllers.
- H. Section 16442 – Panelboards.
- I. Section 16510 – Light Fixtures.

1.03 REFERENCES

- A. National Electrical Contractor's Association: NECA 1 – Standard Practice for Good Workmanship in Electrical Contracting.
- B. National Electrical Manufacturer's Association: NEMA OS 1-2002 – Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
- C. National Fire Protection Association: NFPA 70 – National Electrical Code, latest adopted edition.
- D. International Building Code: Architectural, Mechanical, and Electrical Component Seismic Design Requirements.

1.04 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70, latest adopted edition.
- B. Provide products listed and classified by Underwriters Laboratories, Inc. or an independent testing firm, acceptable to authority having jurisdiction, as suitable for purpose specified and shown.

1.05 QUALIFICATIONS

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

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with NECA 1 - Standard Practice for Good Workmanship in Electrical Contracting.

1.07 PROJECT CONDITIONS

- A. Verify locations of equipment to be supported prior to rough-in.

1.08 DESIGN REQUIREMENTS

- A. Support locations and installation: NFPA 70.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Division 1, and Division 16 and Section 01600.
- B. Accept supports, channels, and accessories on site. Inspect for damage.
- C. Protect support channels and accessories from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.10 COORDINATION

- A. Coordinate Work under provisions of Division 1 and Division 16.
- B. Determine and maintain required separation between supports and other work.
- C. Determine and provide support locations to avoid interference with other work.

PART 2 - PRODUCTS

2.01 PRODUCT REQUIREMENTS

- A. Materials and Finishes: Provide adequate corrosion resistance.
- B. Provide materials, sizes, and types of anchors, fasteners, and supports to carry the loads of equipment and conduit. Include weight of wire in conduit when selecting products.
- C. Anchors and Fasteners:
 - 1. Steel Structural Elements: Use beam clamps or welded fasteners.
 - 2. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts.
 - 3. Sheet Metal: Use sheet metal screws.
 - 4. Wood Elements: Use wood screws.

2.02 STEEL CHANNEL

- A. Description:
 - 1. Indoor Dry Locations: Galvanized or Painted steel.
 - 2. Outdoor Locations: Galvanized steel.
 - 3. Wet and Damp Locations: Galvanized steel.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Provide products in accordance with manufacturer's instructions.
- B. Provide anchors, fasteners, and supports in accordance with NECA 1 - Standard Practice for Good Workmanship in Electrical Contracting.
- C. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- D. Do not use spring steel clips and clamps.
- E. Do not use powder-actuated anchors.
- F. Do not drill or cut structural members.
- G. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- H. Provide surface-mounted cabinets and panelboards with minimum of four anchors.
- I. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION

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SECTION 16075
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Nameplates and labels.
- B. Wire and cable markers.

1.02 RELATED SECTIONS

- A. Division 1 – General Requirements.
- B. Section 13851 – Fire Alarm Systems.
- C. Sections 16010 – Basic Electrical Requirements.
- D. Section 16060 – Grounding and Bonding.
- E. Section 16123 – Building Wire and Cable.
- F. Section 16140 – Wiring Devices.
- G. Section 16235 – Engine Generators.
- H. Section 16411 – Enclosed Switches.
- I. Section 16421 – Enclosed Controllers.
- J. Section 16442 – Panelboards.
- K. Section 16510 – Light Fixtures.

1.03 REFERENCES

- A. National Fire Protection Association: NFPA 70 – National Electrical Code, latest adopted edition.

1.04 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70, latest adopted edition.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. or an independent testing firm, acceptable to authority having jurisdiction, as suitable for purpose specified and shown.

1.05 QUALIFICATIONS

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

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with NECA 1 - Standard Practice for Good Workmanship in Electrical Contracting.

1.07 SUBMITTALS

- A. Submit under provisions of Division 1 and Division 16.
- B. Product Data: Provide manufacturer's catalog data for nameplates, labels, and markers.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Division 1 and Division 16.
- B. Protect equipment and accessories damage by storing above grade. Provide appropriate covering.

PART 2 - PRODUCTS

2.01 NAMEPLATES AND LABELS

- A. Nameplates: Engraved three-layer laminated plastic, black letters on white background.
- B. Locations: Each electrical distribution and control equipment enclosure.
- C. Letter Size: Use 1/4 inch letters for identifying equipment and loads.

2.02 WIRE MARKERS

- A. Description: Machine printed heat-shrink tubing type wire markers.
- B. Locations: Each conductor at panelboard, conductor splices in pull, outlet and junction boxes and each load connection.
- C. Legend:
 - 1. Power and Lighting Circuits: Panelboard number, branch circuit or feeder number.
 - 2. Control Circuits: Control wire number indicated on shop drawings.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive nameplates and labels.

3.02 APPLICATION

- A. Install nameplates parallel to equipment lines.
- B. Secure nameplate to equipment front using screws or permanent adhesive.

END OF SECTION

SECTION 16123
BUILDING WIRE AND CABLE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Building wire and cable.

1.02 RELATED SECTIONS

- A. Division 1 – General Requirements.
- B. Section 13851 – Fire Alarm Systems.
- C. Sections 16010 – Basic Electrical Requirements.
- D. Section 16060 – Grounding and Bonding.
- E. Section 16075 – Electrical Identification.
- F. Section 16130 – Raceway and Boxes.
- G. Section 16140 – Wiring Devices.
- H. Section 16235 – Engine Generators.
- I. Section 16411 – Enclosed Switches.
- J. Section 16421 – Enclosed Controllers.
- K. Section 16442 – Panelboards.
- L. Section 16510 – Light Fixtures.

1.03 REFERENCES

- A. National Electrical Contractor's Association: NECA 1 – Standard Practice for Good Workmanship in Electrical Contracting.
- B. International Electrical Testing Association: NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems, latest published edition.
- C. National Fire Protection Association: NFPA 70 – National Electrical Code, latest adopted edition.

1.04 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70, latest adopted edition.
- B. Provide products listed and classified by Underwriters Laboratories, Inc. or an independent testing firm, acceptable to authority having jurisdiction, as suitable for purpose specified and shown.

1.05 QUALIFICATIONS

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

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with NECA 1 - Standard Practice for Good Workmanship in Electrical Contracting.

1.07 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1, and Division 16.

1.08 PROJECT CONDITIONS

- A. Verify in field that dimensions shown on Drawings are reasonably accurate.
- B. Wire and cable routing is not shown on Drawings. Route wire and cable as required to meet Project Conditions.
- C. Determine exact routing and lengths required.

1.09 DESIGN REQUIREMENTS

- A. Building wire and cable sizes: ANSI/NFPA 70.
- B. Conductors shall be copper.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Division 1, and Division 16 and Section 01600.
- B. Accept wire and cable on site. Inspect for damage.
- C. Protect wire and cable from corrosion and damage by storing above grade. Provide appropriate covering.

1.11 COORDINATION

- A. Coordinate Work under provisions of Division 1, and Division 16 and Section 01039.

PART 2 - PRODUCTS

2.01 BUILDING WIRE AND CABLE

- A. Feeders and Building Wiring: Minimum size wire permitted shall be #12 AWG, 98 percent conductivity copper, 600 volt insulation, Type XHHW. Provide 90 deg. C insulation for conductors serving outlets above convector covers and other locations where wiring is installed in close proximity (less than 6" clearance) to hot surfaces such as, ranges, generators, water heaters, and flues.
- B. Branch Circuit Wiring: Conductors: #12AWG minimum.
- C. Exterior and Wet or Damp Location Wiring: XHHW only.

- D. Conducting material for all wiring shall be copper.
- E. Provide permanent tags for each conductor indicating origin and load fed. See Section 16075.
- F. Fixture wireways and other high temperature areas: THHN or XHHW 90 deg. C.
- G. Provide solid conductors for all sizes #10 AWG and smaller. Provide stranded conductors for #8 AWG and larger sizes.
- H. All wiring shall have XHHW insulation except in the case of manufactured fixture whips.
- I. All wiring for applications in systems operating at less than 120 volts line to neutral shall have insulation approved for installation without raceways in air plenums.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building is protected from weather.
- B. Verify that mechanical work likely to damage wire and cable has been completed.
- C. Verify that raceway installation is complete and supported.

3.02 PREPARATION

- A. Completely and thoroughly swab raceways in exterior, underground, wet, and damp locations to remove moisture and debris before installing wire.

3.03 INSTALLATION

- A. Use wiring methods indicated on Drawings and in Specifications.
- B. Provide a separate grounded (neutral) conductor with each branch circuit ungrounded conductor. Three-wire (two phase conductors with shared neutral) branch circuits are not allowed.
- C. Route wire and cable as required to meet Project Conditions.
- D. Use stranded conductors for control circuits.
- E. Use #10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.
- F. Run all wires and cables in raceways. Raceways shall be completed prior to installation of conductors and cables.
- G. Pull all conductors into raceway at same time.
- H. Pull wires to insure that insulation is not damaged.
- I. Allow at least 6 inches of conductor in boxes after splices and connections are made. Do not pull wire until work that might cause damage to wire has been completed.

- J. Provide copper grounding conductors and straps as required for continuity and as indicated in the Drawings and Specifications.
- K. Provide all wire and cable in specified raceways conforming with NEC. Do not exceed NEC fill limits.
- L. Use pulling lubricant for pulling #4 AWG or larger conductors. Pulling lubricant shall not damage wire insulation.
- M. Clean surfaces before installing grounding lugs and connectors.
- N. Make splices, taps, and terminations to carry full ampacity of conductors with no additional temperature rise due to connection.
- O. Use split bolt connectors for copper conductor splices and taps, #6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- P. Use connectors (wire nuts) with insulating covers for conductor splices and taps, #8 AWG and smaller.
- Q. Color code all line voltage conductors with insulation of continuous color to designate neutral conductor, phase (ungrounded) and ground wires (if insulated) per tables, following:
120/240 V.-1 phase, 3 wire:
- | <u>Phase A</u> | | <u>Phase B</u> | | <u>Neutral</u> | | <u>Ground</u> |
|----------------|-----|----------------|-------|----------------|--|---------------|
| Black | Red | White | Green | | | |
- R. Provide connections to circuit breakers, terminal strips, switches, and other devices as follows:
1. #12 AWG Wire: Formed around binding post or screw or terminated under factory lug.
 2. #10 AWG and larger Wire: Terminate on suitable lug.
 3. Stranded conductors shall be terminated with crimp on ring or spade lugs on screw terminal.
- S. Provide joints in wires as follows:
1. Connections and joints in exterior, wet, and damp locations shall be waterproof, encapsulate circuit connections and joints.
 2. Provide joints mechanically and electrically secure and insulate equal to insulation of conductors
 3. Conductor joints and splices shall be made per NFPA 70.
- T. Provide conductor lengths to minimize joints and splices.

3.04 INTERFACE WITH OTHER PRODUCTS

- A. Identify wire and cable under provisions of Section 16075.
- B. Identify each conductor with its circuit number or other designation indicated on Drawings.

3.05 FIELD QUALITY CONTROL

- A. Inspect wire and cable for physical damage
- B. Verify terminations and connections are in accordance with manufacturer's instructions.
- C. Verify continuity of each branch circuit and feeder conductor.

END OF SECTION

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SECTION 16130
RACEWAYS AND BOXES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Rigid metal conduit.
- B. Flexible metal conduit.
- C. Liquid tight flexible metal conduit.
- D. Electrical metallic tubing.
- E. Fittings and conduit bodies.
- F. Wall and ceiling outlet boxes.
- G. Pull and junction boxes.

1.02 RELATED SECTIONS

- A. Division 1 – General Requirements.
- B. Section 13851 – Fire Alarm Systems.
- C. Sections 16010 – Basic Electrical Requirements.
- D. Section 16060 – Grounding and Bonding.
- E. Section 16070 – Hangers and Supports.
- F. Section 16123 – Building Wire and Cable.
- G. Section 16140 – Wiring Devices.
- H. Section 16411 – Enclosed Switches.
- I. Section 16421 – Enclosed Controllers.
- J. Section 16442 – Panelboards.
- K. Section 16510 – Light Fixtures.

1.03 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI C80.1-1994 – Rigid Steel Conduit, Zinc Coated, Specification for.
 - 2. ANSI C80.3-1994 – Electrical Metallic Tubing, Zinc Coated, Specification for.
- B. National Electrical Contractor's Association: NECA 1 – Standard Practices for Good Workmanship in Electrical Contracting.
- C. National Electrical Manufacturer's Association:

1. NEMA 250-2003 – Enclosures for Electrical Equipment (1000 Volts Maximum).
 2. NEMA FB 1-2003 – Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable Assemblies.
 3. NEMA OS 1-2002 – Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
- D. National Fire Protection Association: NFPA 70 – National Electrical Code, latest adopted edition.

1.04 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70, latest adopted edition.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. or an independent testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

1.05 QUALIFICATIONS

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

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with NECA 1 - Standard Practice for Good Workmanship in Electrical Contracting.

1.07 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1, and Division 16 and Section 01700.
- B. Accurately record actual routing of conduits larger than 2 inches.
- C. Accurately record actual locations of pull and junction boxes on as-built drawings.

1.08 PROJECT CONDITIONS

- A. Verify in the field that dimensions shown on Drawings are reasonably accurate.
- B. Verify routing and locations of conduit terminations prior to rough-in.
- C. Verify locations of boxes and outlets prior to rough-in.
- D. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Division 1, and Division 16.
- B. Accept raceways and boxes on site. Inspect for damage.

- C. Protect raceways and boxes from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.10 COORDINATION

- A. Coordinate Work under provisions of Division 1, and Division 16.
- B. Determine and maintain required separation between conduits and other work.
- C. Determine and provide conduit locations to avoid interference with other work.

PART 2 - PRODUCTS

2.01 CONDUIT REQUIREMENTS

- A. Minimum Size: 1/2 inch diameter unless otherwise specified.
- B. Outdoor Locations, Above Grade: Use rigid steel conduit.
- C. Wet and Damp Locations: Use rigid steel conduit. Connections to equipment to reduce vibration, liquidtight flexible metal conduit may be used.
- D. Dry Locations: Use electrical metallic tubing. Connections to equipment to reduce vibration, flexible metal conduit may be used.

2.02 METAL CONDUIT

- A. Rigid Steel Conduit: ANSI C80.1.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; material to match conduit.

2.03 FLEXIBLE METAL CONDUIT

- A. Description: Interlocked steel construction.
- B. Fittings: ANSI/NEMA FB 1.

2.04 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Description: Interlocked steel construction with PVC jacket.
- B. Fittings: ANSI/NEMA FB 1.

2.05 ELECTRICAL METALLIC TUBING (EMT)

- A. Description: ANSI C80.3; galvanized tubing.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel compression type.

2.06 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, galvanized steel.
 - 1. Light Fixture Supporting Boxes: Four inch octagon boxes rated for weight of equipment supported; include 1/2 inch male fixture studs where required. Provide additional supports and boxes for large fixtures per NEC.

- B. Provide 4-inch square, 2 1/8-inch deep, minimum boxes except where smaller units are required by equipment.
- C. Exterior or Wet Location Boxes: Cast steel, deep type, with threaded hubs, NEMA 4, size as required for application with gasketed cover plate. Provide each cast box with at least one spare 1/2 inch diameter tapped and threaded hub with flush plug for possible future expansion in addition to hubs required for this Project.
- D. Flush Mounting In Walls: Four inch square boxes with matching plaster ring for single- or two-gang outlets. For larger boxes use solid type boxes for 3, 4, etc. gang boxes. Provide outlet boxes for special equipment in accordance with equipment manufacturer's instructions.

2.07 PULL BOXES AND JUNCTION BOXES

- A. Surface Mounted Pull and Junction Boxes: Metal construction, conforming with National Electrical Code requirements, with screw-on cover.
- B. Flush Mounted Pull and Junction Boxes: Provide with covers overlapping wall finish with counter-sunk flush cover screws of the retained type.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Arrange supports to prevent misalignment during wiring installation.
- B. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- C. Fasten conduit supports to building structure and surfaces under provisions of Section 16070.
- D. Do not permanently support conduit with wire or perforated pipe straps.
- E. Remove temporary conduit supports after permanent supports are in place.
- F. Do not attach conduit to ceiling support wires.
- G. Arrange conduit to maintain headroom and present neat appearance.
- H. Provide electrical boxes to maintain headroom and to present neat mechanical appearance. Route exposed conduit parallel and perpendicular to walls.
- I. Maintain adequate clearance between conduit and piping.
- J. Maintain 12 inch clearance, minimum between conduit and surfaces with temperatures exceeding 104 degrees F.
- K. Provide no more than equivalent of four 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, such as around beams. Provide factory elbows for bends in metal conduit larger than 2 inch size, factory elbows may be used for bends in conduits smaller than 2-inches.

- L. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- M. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- N. Ground and bond conduit under provisions of Section 16060.
- O. Securely install raceways parallel to and/or at right angles to building lines and features. Provide minor alterations of routing where required to suit field conditions.
- P. All boxes shall be mounted square and plumb. All installations not true with respect to horizontal, vertical, and/or building lines or otherwise improperly installed shall be corrected and/or removed and completely reinstalled properly, at the discretion of the Department, at no cost to the Department.
- Q. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements.
- R. Provide pull boxes and junction boxes larger than 144 cubic inches above accessible ceilings and in unfinished areas only.
- S. Inaccessible Ceiling Areas: Provide outlet boxes and junction boxes no more than 6 inches from ceiling access panel or from removable recessed light fixture.
- T. Install conduit and boxes to preserve fire resistance rating of partitions and other elements.
- U. Use flush mounting outlet boxes in finished areas.
- V. Do not install flush mounted boxes back-to-back in walls; provide minimum one stud bay separation. Provide minimum two stud bays separation in acoustic rated walls and rated firewalls.
- W. Use steel bridges to fasten flush mounting outlet box between studs.
- X. Provide flush mounting boxes without damaging wall insulation or reducing its effectiveness. Repair damaged vapor retarder membranes in accordance with Division 7 and Department instructions. For boxes mounted in exterior walls intended for interior outlets, provide insulation behind outlet boxes and adequately patch vapor barrier to prevent condensation in boxes or on building surfaces, in accordance with Division 7 and Division 16. Seal all conduit penetrations with silicone sealant in each box, provided after all conductors are in place.
- Y. Do not fasten boxes to ceiling support wires or raceways.
- Z. Provide support for boxes independent of conduit.
- AA. Provide manufactured multi-gang box where more than two devices are mounted in a single box. Do not use screw together sectional boxes.

- BB. Large Pull Boxes: Boxes larger than 144 cubic inches in volume or 6 inches in any dimension.
- CC. Provide engraved nameplate identifying junction box heat trace cable circuits, including serving load center and voltage. See Section 16075.

3.02 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate mounting heights and locations of outlets mounted above counters and backsplashes.
- B. Position outlet boxes to locate light fixtures as shown on Drawings. Coordinate with architectural reflected ceiling plan in areas with lay-in grid type ceilings.

3.03 ADJUSTING

- A. Adjust flush-mounting outlets to make front flush with finished wall material.
- B. Provide knockout closures in all unused box openings.

3.04 CLEANING

- A. Clean under provisions of Division 1 and Division 16.
- B. Clean electrical parts to remove conductive and harmful materials.
- C. Remove dirt and debris from enclosure.
- D. Clean finishes and touch-up damage.

END OF SECTION

SECTION 16140
WIRING DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Wall switches.
- B. Receptacles.
- C. Device plates and box covers.

1.02 RELATED SECTIONS

- A. Division 1 – General Requirements.
- B. Sections 16010 – Basic Electrical Requirements.
- C. Section 16060 – Grounding and Bonding.
- D. Section 16075 – Electrical Identification.
- E. Section 16123 – Building Wire and Cable.
- F. Section 16130 – Raceway and Boxes.

1.03 REFERENCES

- A. National Electrical Contractors Association: NECA 1 – Standard Practice for Good Workmanship in Electrical Contracting.
- B. National Electrical Manufacturers Association:
 - 1. NEMA WD 1-1999 – General Color Requirements for Wiring Devices.
 - 2. NEMA WD 6-2002 – Wiring Devices Dimensional Requirements.
- C. National Fire Protection Association: NFPA 70 – National Electric Code, latest adopted edition.

1.04 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70, latest adopted edition.
- B. Provide products listed and classified by Underwriters Laboratories, Inc. or an independent testing firm, acceptable to authority having jurisdiction, as suitable for purpose specified and shown.

1.05 QUALIFICATIONS

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

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with NECA 1 - Standard Practice for Good Workmanship in Electrical Contracting.

1.07 SUBMITTALS

- A. Submit under provisions of Division 1 and Division 16.
- B. Product Data: Provide manufacturer's standard catalog information showing dimensions, colors, and configurations.

1.08 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1 and Division 16.
- B. Accurately record each device type, actual locations, of wiring devices on as-built Drawings.

1.09 PROJECT CONDITIONS

- A. Verify in the field locations of boxes and outlets in offices and work areas with project conditions prior to rough-in.
- B. Devices are shown schematically in approximate locations unless dimensioned. Provide at location required to serve intended purpose.

1.10 DESIGN REQUIREMENTS

- A. Device locations and installation: NFPA 70.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Division 1 and Division 16.
- B. Accept devices on site. Inspect for damage.
- C. Protect devices from corrosion and entrance of debris by storing above grade with appropriate covering.

1.12 COORDINATION

- A. Coordinate Work under provisions of Division 1 and Division 16.
- B. Determine and maintain required separation between devices and other work.
- C. Avoid interference with other work.

PART 2 - PRODUCTS

2.01 WALL SWITCHES

- A. Manufacturers:
 - 1. Hubbell 20A, 1221 series.
 - 2. Bryant 20A, 4901 series.

3. Substitutions: Under provisions of Division 1 and Division 16.
- B. Description: NEMA WD 1, heavy-duty, AC only general-use snap switch, quiet, slow make, slow break design, toggle handle, fully rated for inductive and resistance loads.
- C. Device Body: Ivory plastic with toggle handle.
- D. Voltage Rating: 120/277 volts, AC.
- E. Current Rating: 20 amperes.
- F. Ratings: Match branch circuit and load characteristics.
- G. Provide matching 2-pole, 3-way, 4-way switches.

2.02 RECEPTACLES

- A. Manufacturers:
 1. Hubbell. 20A: 5362 series.
 2. Bryant. 20A: 5362 series.
 3. Substitutions: Under provisions of Division 1 and Division 16.
- B. Description: NEMA WD 1; heavy-duty general-use receptacle 20 ampere, 125 volts, duplex Specification grade.
- C. Device Body: Ivory plastic.
- D. Configuration: NEMA WD 6; type as specified and indicated.
- E. Convenience Receptacle: NEMA 5-20R
- F. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements and as indicated on drawings or required by application.

2.03 WALL PLATES

- A. Decorative Cover Plate: Smooth 302 stainless steel.
 1. Hubbell.
 2. Bryant.
 3. Substitutions: Under provisions of Division 1 and Division 16.
- B. Weatherproof Cover Plate: Cast metal with hinged gasketed device cover.
 1. Hubbell.
 2. Bryant.
 3. Substitutions: Under provisions of Division 1 and Division 16.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify wall openings are neatly cut and will be completely covered by wall plates.
- B. Verify boxes are located and adjusted properly.

3.02 INSTALLATION

- A. Provide products in accordance with manufacturer's instructions.
- B. Provide devices plumb and level.
- C. Provide receptacles with grounding pole on bottom (vertical mounting) or left (horizontal mounting).
- D. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.
- E. Provide decorative plates on switch, receptacle, and blank outlets in finished areas.
- F. Connect wiring devices by terminating conductor on screw terminal or under screw compression clamp. Back wiring using of stab in terminals of devices shall not be permitted.
- G. Provide galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets in dry areas accessible to authorized personnel only.

3.03 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations of wiring devices and outlet boxes provided under Section 16130 to obtain mounting heights as specified and indicated on Drawings.

3.04 FIELD QUALITY CONTROL

- A. Inspect each wiring device for defects.
- B. Operate each wall switch with circuit energized and verify proper operation.
- C. Verify that each receptacle device is energized and is wired for proper polarity.
- D. Test each GFCI receptacle device for proper operation.
- E. Provide new device for each device that is defective or does not operate properly.

3.05 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

END OF SECTION

SECTION 16235
ENGINE GENERATORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Diesel Generator Power Systems.
- B. Diesel Generator Module.
- C. Gasoline Generator Power Systems
- D. Coordination and Interconnections with Other Systems and Features.

1.02 PROJECT DESCRIPTION AND SCOPE

- A. This Section is a performance Specification identifying the minimum equipment and operational features required for two complete fully operational pre-manufactured engine generator module systems operating in Prime Mode. The packaged engine generator system consists of two stand alone independent generator modules including one each diesel-generator with heat, ventilation, fuel system, lighting and power systems as identified in this Specification and on the Drawings. Each generator module shall include space for future heat recovery equipment.
- B. Generator sizing is based on an assumption that each generator can provide sufficient power for approximately one-half of the facilities electrical load. Manual load shedding may be necessary to maintain the electrical load with the capacity of the generator.

1.03 RELATED SECTIONS

- A. Division 1 – General Requirements.
- B. Section 15010 – General Mechanical Requirements
- C. Section 15075 – Mechanical Identification
- D. Section 15080 – Mechanical Insulation
- E. Section 15191 – Fuel Oil Piping
- F. Section 15810 – Ducts
- G. Section 15820 – Duct Accessories
- H. Sections 16010 – Basic Electrical Requirements.
- I. Section 16060 – Grounding and Bonding.
- J. Section 16075 – Electrical Identification.
- K. Section 16123 – Building Wire and Cable.
- L. Section 16130 – Raceway and Boxes.

- M. Section 16411 – Enclosed Switches.
- N. Section 16442 – Panelboards.

1.04 REFERENCES

- A. National Fire Protection Association:
 - 1. NFPA 70 – National Electrical Code, latest adopted edition.

1.05 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70, latest adopted edition.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. or an independent testing firm, acceptable to authority having jurisdiction, as suitable for purpose specified and shown.
- C. Generators manufactured to NEMA standards.

1.06 QUALIFICATIONS

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

1.07 QUALITY ASSURANCE

- A. Perform Work in accordance with NECA 1 - Standard Practice for Good Workmanship in Electrical Contracting.

1.08 SUBMITTALS

- A. Submit under provisions of Division 1, Division 7, Division 15 and Division 16.
- B. Submit engine data with shop drawings. Include the following minimum information in the submittal.
 - 1. Generator power rating in kVA and kW
 - 2. Generator Power Factor (pf)
 - 3. Control panel layout
 - 4. Unit dimensions in length, width and height.
 - 5. Unit weight
 - 6. Radiator dimensions, net required louver area for cooling air in square inches.
 - 7. Required airflow in CFM and temperature at rated speed for maintaining recommended ambient generator temperature.
 - 8. Engine coolant capacity.
 - 9. Radiator coolant capacity.
 - 10. Engine lubrication oil capacity.

11. Jacket water heater kW, Voltage, Phase.
 12. Calculation of minimum time required to increase generator block temperature from -35 F to +20F utilizing a jacket water heater rated at 3kW, 240V, single-phase.
 13. Fuel use curve as a function of load in kW or kVA.
 14. Heat rejection to jacket water curve as a function of load kW or kVA. Provide data in BTUs/min and kW/min. Include separate loads for secondary coolant circuits such as after coolers.
 15. Heat rejection to ambient air (surrounding space) as a function of load kW or kVA. Provide data in BTUs/min and kW/min.
- C. Submit data showing compliance with Tier 3 requirements, include at a minimum:
1. Nox g/hp-hr.
 2. CO g/hp-hr.
 3. HC g/hp-hr.
 4. PM g/hp-hr
- D. Submit manufacturer's installation instructions.
- E. Submit manufacturer's descriptive literature, operating instructions, maintenance and repair data.
- F. All items above shall be submitted as a single package. Partial submittals will be returned, or held unchecked until all information is submitted. Following acceptance of this submitted material by the Department.
- G. Within 14 days after completed tests, provide certified results of load tests and break-in for each completely assembled diesel unit.
- H. Break-in shall be accomplished with generation units and control panels operating to simulate field installation. At the end of the break-in/load test of the units, certify all shutdowns are operational by simulating condition initiating each required shutdown. Submittals shall indicate method of simulation associated with each shutdown test.
- I. Provide submittals, certifications, and other documentation required by other parts of this Section, other Sections within this Division, and other Divisions in this Specification. See on-site testing requirements in Part 3 EXECUTION.
- J. Submit recorded performance data to Department for evaluation before request for substantial completion inspection.

- K. Submit generator module information. Include the following minimum information:
1. Product data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of the following generator module components:
 - a. Structural framing system including support framing for mechanical and electrical equipment.
 - b. Foundation components if required.
 - c. Generator set support appurtenances including, but not limited to, day tank, fuel piping and accessories, pipe and duct insulation, ventilation fans, control dampers, backdraft dampers, exhaust silencers, bellows, termination thimble, compression/expansion tank, and major control system components.
 2. Shop Drawings: For the following generator module components. Include plans, elevations, sections, details, and attachments to other work.
 - a. Scaled drawing noting general equipment layout of the module notating locations of generators, radiator intakes/discharges, support equipment, future waste heat recovery equipment, and panel locations.
 - b. For installed products necessary to comply with design loads, include structural analysis data, including engineering calculations, signed and sealed by the qualified professional engineer responsible for their preparation. The qualified professional engineers shall be a registered professional engineer in the state of Alaska.
 - c. Structural Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections. Show connections to mechanical and electrical equipment.
 - d. Generator Skid : Show complete fabrication of generator skid . Include welds and bolted connections .
 - e. Control system drawings noting sequences and proposed system schematics of systems that control room and engine temperature, generator operation, fueling system, and any alarms related to these systems.
 - f. Provide system schematics for jacket water and secondary cooling circuits, fuel oil systems, and radiator air cooling. Provide additional system schematics as required to show the working

relationships of the equipment and supporting systems provided for the module.

3. Accessory Drawings: Include details of the following items:
 - a. Louvers
 - b. The engine exhaust system including bellows, silencer, thimble, and exhaust stack termination.
 - c. Weather hoods
 - d. Protective Canopies
4. Product Certificates: For each type of generator module, signed by the product manufacturer.
 - a. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
 - 1) Name and location of project.
 - 2) Order Number
 - 3) Name of Manufacturer.
 - 4) Name of Contractor.
 - 5) Module dimensions including width, length, height, and roof slope.
 - 6) Governing Building Code and year of edition.
 - 7) Design Loads: Include dead loads, collateral loads, snow loads, wind loads, seismic loads, and any other know loading conditions.
 - 8) Load combinations: Indicate the loads that were applied simultaneously with concentrated loads, accordin to governing building code.
5. Material Test Reports: Signed by manufacturer certifying that products comply with requirements:
 - a. Structural steel including chemical and physical properties.
 - b. Shop Primers.
 - c. Foundation Elements.

1.09 FACTORY START-UP AND TESTING

- A. Provide factory start-up and testing Notify the Department a minimum of 14 calendar days prior to scheduled testing.

- B. Provide the services of a factory-authorized, factory trained representative of the diesel engine generator set manufacturer to inspect assembled components, and equipment installation and supervise the tests
- C. When the complete engine generator power system has been assembled, test all components of the system in the presence of the Department for proper operation of the individual components and the complete system and to eliminate electrical and mechanical defects.
- D. Furnish fuel oil, lubricating oil, anti-freeze liquid, water treatment and rust inhibitor and load bank for testing of the diesel engine generator set.
- E. Tests for the Diesel Engine Generator Set:
 - 1. Test the engine generator set for eight hours of continuous operation as follows:
 - a. First six hours while the set is delivering 100 percent of its specified KW rating.
 - b. Last two hours while the set is delivering 110 percent of its specified KW rating.
 - c. If during the 8-hour continuous test a failure occurs, either the diesel engine shuts down or the full KW rating of the load bank is not achieved, the test is null and void. The test(s) shall be repeated until the satisfactory results are attained at no additional cost to the Department.
 - 2. Record the following test data at 30-minute intervals:
 - a. Time of day, also reading of running time indicator.
 - b. KW.
 - c. Voltage (Phase-to-Phase and Phase to Neutral).
 - d. Amperes on each phase.
 - e. Engine RPM.
 - f. Frequency.
 - g. Engine water temperature.
 - h. Fuel pressure
 - i. Oil pressure.
 - j. Coolant temperature.
 - k. Lubricating oil temperature.

3. Demonstrate that the generator set will attain proper voltage, frequency and will accept 100 percent block load within 30 seconds from a cold start after the closing of a single contact.
 4. Furnish a resistance type load for the testing of the generator:
 5. Test loads shall include adequate resistance to assure stability of the loads and equipment during all of the testing operations. The test load KW rating shall not be less than 110 percent of the specified KW rating of the largest generator set.
- F. Battery and Starting System Test:
1. Demonstrate that the batteries and cranking motor are capable of 3 starting attempts of 10 second cranking each at 10 second intervals with the battery charger turned off.
- G. Control Panel Test: Simulate engine failures while checking for proper operation of each indicating lamp, alarm device and reset button.
- H. When any defects are detected during the tests, correct all the deficiencies and repeat all or part of the 8-hour continuous test as requested by the Department, at no additional cost to the Department.
- I. Submit test and inspection results in writing to the Department.

1.10 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1, Division 15 and Division 16.
- B. Accurately record actual size and location of each Diesel Engine Generator and module on As-built Drawings as well as all supporting systems.

1.11 PROJECT CONDITIONS

- A. Coordinate locations of Package Engine Generator Set(s) prior to rough-in.

1.12 DESIGN REQUIREMENTS

- A. Package Engine Generator Set size: ANSI, IEEE, NFPA 70.
- B. Fuel Oil Systems: NFPA 30, NFPA 31.

1.13 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Division 1, Division 15, and Division 16.
- B. Accept Package Engine Generator Set on site. Inspect for damage.
- C. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

- D. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components.

1.14 COORDINATION

- A. Coordinate Work under provisions of Division 1, Division 15 and Division 16.
- B. Determine required separation between Package Engine Generator Set and other work.

1.15 OPERATION AND MAINTENANCE DATA

- A. Submit manufacturer's operation data under provisions of Division 1, Division 15, and Division 16.
- B. Submit maintenance data under provisions of Division 1, Division 15 and Division 16. Provide parts lists for the equipment provided. Provide contact information for where parts and service can be obtained for each piece of equipment.
- C. Include maintenance instructions for cleaning methods, cleaning materials recommended, replacement, testing and adjustment, and lubrication.
- D. Provide written step-by-step operational instructions for preparing and starting the generators from a "cold-soaked condition". Provide separate instructions on how to shut down and prepare the generator and module systems for prolonged inactivity. Laminate and mount the final written instructions both inside of the generator module and the Evacuation Center mechanical room. Provide copies in the Operation and Maintenance Manuals.

Sample start-up instructions are as follows:

Start-up Procedure:

1. Verify sufficient gasoline fuel is available for Generator G-3.
2. Start Generator G-3.
3. Install starting batteries for both generators.
4. Close Manual Transfer Switch (MTS) GP-1 to GEN-3
5. Turn on Generator GEN-1 Jacket Water Heater Circuit Breaker.
6. Turn on Generator GEN-1 Battery Heater Circuit Breaker
7. Turn on Day Tank Circuit Breaker
8. Monitor Generator GEN-1 Jacket Water temperature.
9. When GEN-1 Jacket Water Temperature reaches +20F, Start GEN-1.
10. After GEN-1 is running and reaches Mfg recommended operating temperature.
11. Close MTS M to GEN-1

12. Close MTS EP-1 to GEN-1
13. Close MTS GP-1 to MTS M
14. Turn on Generator GEN-2 Jacket Water Heater Circuit Breaker in Panel GP-2.
15. Turn on Generator GEN-2 Battery Heater Circuit Breaker in Panel GP-2.
16. Monitor Generator GEN-2 Jacket Water temperature.
17. When GEN-2 Jacket Water Temperature reaches +20F, GEN-2 may be started.
18. After GEN-2 is running and reaches Mfg recommended operating temperature.
19. Close MTS NP-1 to G-2
20. Start-up mechanical equipment.
21. Monitor MEC Building Temperature.
22. When interior building temperature reaches +40F for a minimum of four hours:
23. Turn on circuit breakers for other non-mechanical equipment in Panel EP-1.
24. Place back-up batteries in Fire Alarm Panel.
25. Perform Fire Alarm System start-up, testing, and diagnostics as recommended by manufacturer
26. Turn on circuit breakers in Panels EP-1 and NP-1.

Shut Down Procedure:

1. Shut down all non-mechanical systems and equipment in MEC building fed from panel EP-1 and NP-1.
2. See Shut Down Procedure for Mechanical Equipment.
3. After non-essential mechanical and other equipment is shut down, turn off all circuit breakers in panels EP-1 and NP-1.
27. Turn off all circuit breakers in panels GP-1 and GP-2.
28. Shut down Generators GEN-1 and GEN-2.
29. Open all manual transfer switches.
30. Remove batteries from Fire Alarm Panel move to warm storage area with trickle charging capacity. Maintain charge to batteries.
31. Remove generator start batteries from generator modules move to warm storage area with trickle charging capacity. Maintain charge to batteries.

PART 2 - PRODUCTS

2.01 DIESEL ENGINE GENERATORS

- A. Description of Systems:
1. Power system for supply of power, consisting of two each Prime duty, complete, self-contained, liquid-cooled, diesel engines each directly coupled to an AC generator complete with bases, fittings, connections, auxiliaries, control panels, safety devices, meters and all other equipment including but not limited to start batteries, cooling fans, radiators, fuel and cooling pumps as required.
 2. Each Unit shall be identical in size and configuration and capable of delivering the minimum kW and kVA as shown on the Drawings.
- B. Acceptable Manufacturers:
1. Each engine, generator, and all major items of auxiliary equipment shall be manufactured in the U.S. by manufacturers currently engaged in the production of such equipment. Each unit shall be factory assembled and tested by the engine manufacturer and shipped to the job site by his authorized dealer having a parts and service facility in the State of Alaska.
 - a. Caterpillar.
 - b. Cummins.
 - c. Kohler.
 - d. MTU
 - e. Substitutions: Under provisions of Division 1 and Division 16.
 2. The engine-generator manufacturer shall have had a complete engineering, sales, installation, service and support organization and operation within Alaska for a period of not less than 5 years prior to this Project's bid date.
- C. Typical Construction:
1. Each unit shall be mounted on a steel rail base with Mason springs and snubbers. Springs and snubbers shall be constructed and installed in strict accordance with manufacturer's instructions. Mounting arrangement shall permit removing oil pan without moving generation unit. The steel rail base shall be mechanically connected to the structure, see structural details for connections.
 2. The engine-generator spring-isolators (with seismic snubbers) shall be sized for a maximum of 50% compression when unit is loaded. Springs shall be housed and manufactured by Mason Industries or equal. Coordinate with structural and other Divisions.

D. Generator Set Characteristics:

1. Prime Rating at 0.8 power factor, maximum, 60 Hz.,
2. The specified KW shall be available for continuous (Prime) electrical service.
3. All ratings must be substantiated by manufacturer's standard published curves and confirmed by factory load test reports. Special ratings or maximum ratings are not acceptable.
4. The generator shall be connected to provide 240/120 V., Single-phase, three-wire supply. The neutral shall be accessible for connection to the distribution system.
5. Regulator: A generator mounted volts-per-Hertz type regulator shall be provided to match the characteristics of the generator and engine. Voltage regulation shall be +2% from no load to full rated load. Readily accessible voltage droop, voltage level and voltage gain controls shall be provided. Voltage level adjustment shall be a minimum of +5% of rated voltage. The solid state regulator module shall be shock mounted and epoxy encapsulated for protection against vibration and atmospheric deterioration.
6. A generator mounted molded case main (line) two-pole circuit breaker of minimum 250 ampere trip with characteristics as recommended by generator manufacturer for proper generator protection shall be installed as a load interrupting and overcurrent protection device. It shall operate both manually for normal switching function and automatically during overload and short circuit conditions.
7. The trip unit for each pole shall have elements providing inverse time delay during overload conditions and instantaneous magnetic tripping for short circuit protection. The circuit breaker shall meet standards established by Underwriters' Laboratories, National Electrical Manufacturers' Association and National Electrical Code.
8. Provide bonding of all parts of systems in accordance with Section 16060.
9. Each unit shall be provided with contacts, relays, sensors, operators, etc. as required to completely integrate this system with all other systems and equipment. See Division 15.

E. Engine:

1. 1800 RPM, liquid-cooled in-line or V-type four-cycle compression ignition diesel and meet specifications when operating on No.2 domestic diesel oil. Diesel engines requiring premium fuels will not be considered. Equip the engine with fuel filters, lube oil filters, intake air filters; lube oil coolers, fuel transfer pump, fuel priming pump and coolant pump.

2. Provide each engine with a factory installed isochronous electronic governor to maintain frequency regulation within 5% (3 Hertz) from no load to full load.
 3. Provide engine with minimum 3kW, 240V, single-phase jacket water heater (block heater) for generator preheating.
- F. Safety Devices:
1. High coolant temperature shutdown.
 2. Low oil pressure shutdown.
 3. Over-speed shutdown.
 4. Engine over-crank shutdown.
 5. High lube oil temperature shutdown.
 6. Fail to start shutdown. Controls shall include a 45 second single cranking cycle limit with alarm and lockout and manual reset.
 7. Underspeed shutdown.
 8. Overspeed shutdown.
 9. Loss of engine speed detection shutdown.
- G. Turbo-Charging: The engine may be turbo-charged to meet horsepower requirements at the specified power rating.
- H. Cooling Equipment:
1. Provide an engine mounted radiator with blower type fan sized to maintain safe operation at 50 degrees F maximum ambient temperature. Equip the radiator with a duct adapter flange. Air flow restriction from the radiator shall not exceed 0.5" water gauge. Coordinate with Division 15: Mechanical.
 2. Anti-freeze: Each engine cooling system shall be filled with a solution of 50% propylene glycol, 50% water.
 3. The glycol selected shall include a suitable rust-inhibitor and shall be specifically manufactured for use in cooling systems of internal combustion engines.
 4. Provide additional circulation pumps beyond the engine coolant pump as required to address system pressure drop during cold start-up.
 5. Provide compression or expansion tanks for coolant system per the generator manufacturer's recommendations.

6. Provide additional secondary coolant systems as required by the generator manufacturer for Tier 3 compliance, such as after-cooler circuits. Requirements for the secondary coolant system is the same as noted above.
- I. Fuel System:
 1. Provide an two dual externally mounted fuel filters Racor or approved equal for each engine
 2. Provide engine-mounted fuel filter, fuel pressure gauge, and engine fuel priming pump.
 - J. Exhaust Systems:
 1. Exhaust Silencer(s): Provide properly sized, critical area silencer including flexible exhaust fitting for remote mounting.
 2. Installation: Coordinate with Division 15. Mount silencer(s) so its weight is not supported by the engine. Exhaust pipe sizes shall be sufficient to maintain exhaust back pressure well within maximum limitations specified by the engine manufacturer.
 - K. Automatic Starting Systems:
 1. Each Unit shall incorporate a starting system with these characteristics.
 - a. Starting Motor: Provide a 12-volt DC electric starting system with positive engagement drive.
 - b. Automatic Controls: Provide a fully automatic generator set start-stop controls in the generator control panel. Provide two sets of field convertible auxiliary contacts for activating accessory items.
 - c. Batteries: Provide a 12-volt, lead-acid storage battery set of the heavy-duty diesel starting type for each unit, of sufficient capacity to provide ten minutes total cranking time without recharging and rated no less than 380 cold cranking amperes. Provide battery racks, necessary cables and clamps.
 - d. Battery Charger: Provide a current limiting battery charger for each unit to automatically recharge batteries, float at 2.17 volts per cell and equalize at 2.33 volts per cell. Include overload protection, silicon diode full-wave rectifiers, voltage surge suppressors, DC ammeter, a fused AC input. AC input voltage shall be 120V.
 - L. Battery Charging System:
 1. Provide battery charger compatible with generator manufactures standard starting battery capable of charging battery after engine start and

- maintaining battery float charge for two engine generator start batteries plus a minimum of one additional Group 35, 59-AH, 770-CCA battery .
2. Provide two 80W minimum, 120V battery pad heaters with cord and plug connection. Locate one battery heater under generator start battery for GEN-1 and GEN-2.

2.02 GENERATOR MODULE

- A. Building Structure:
 1. Primary and secondary structural members shall be structural steel. Building structural members must meet the load requirements as indicated on the structural drawings.
 2. Module construction shall be non-combustible.
 3. Foundation: If foundation elements are required, they shall be capable of resisting the loads as indicated on the structural drawings. Foundation elements shall not be constructed of cast-in-place concrete.
 4. Module floor shall be insulated and mounted on rails or other structure elevating the module a minimum of 12 inches above finish grade.
- B. Finishes:
 1. Interior finish surfaces shall be of a non-absorbent material.
 2. Flooring material system shall be water tight and non-reactive with diesel fuel.
- C. Thermal Insulation: Provide minimum foamed in place insulation with rating of minimum R-20 in walls floors and ceilings. The thermal insulation shall be in addition to any sound attenuation insulation required by this Section.
- D. Heating: Provide a ceiling or wall mounted forced air electric unit heater capable of maintaining the interior temperature at 50 F minimum, when exterior temperature is minus 35 F.
- E. Ventilation:
 1. Provide air cooling system for generator radiators.
 - a. Radiators to have ducted relief air system with control dampers that will either discharge the air to the exterior or back into the module to maintain minimum space temperatures. Control of the dampers shall be automatic and be controlled based on room temperature.
 - b. Radiator make-up air shall be provided via an automatic outside air control damper.
 - c. Intakes and exhaust shall be provided with hoods or arctic tees.

2. Module room temperature cooling.
 - a. Provide an air cooling system to offset heat radiated from the engine and generator equipment.
 - b. Air shall be blown into the module to cool the space. Temperature control shall ensure that temperatures do not drop below 50 degrees during operation.
 3. All control dampers to the exterior shall be insulated control dampers with cold temperature seals, Tamco or equal.
 4. Ductwork shall be constructed and supported in accordance with SMACNA Standards and Section 15810.
 5. Ductwork shall be insulated in accordance with Section 15080.
- F. Fuel System
1. Day Tank: Provide one day tank for each generator to provide minimum generator operation per NFPA 31, minimum of 25 gallons of storage. Day tanks are to have the following components:
 - a. Rupture basin
 - b. Pre-packaged, duplex fill pump setup with automatic duplex pump controller.
 - c. Manual hand-pump with swing check and 1" ball valve.
 - d. Tank vent routed to exterior located a minimum 10 ft above grade and 10 ft from any intake into the module including doors.
 - e. Floats and alarms for low and high fuel levels.
 2. Piping Hangers: Provide fuel piping hangers per Section 15060.
 3. Piping Identification: Provide piping identification per Section 15075.
 4. Fuel Piping: Provide fuel piping per Section 15191.
 5. Generator Connection Trim:
 - a. Separate fuel oil supply and return pipes shall be run from the day tank to the generator.
 - b. Provide fuel rated isolation valve, oil safety valve, and fusible link valve at each generator supply line.
 - c. Provide check valve on return piping.
 - d. Provide flexible fuel connections at engine and at day tank.
 - e. Provide 2" high, liquid tight drip pan under valves and filters.
 - f. Provide fusible isolation valve at fuel supply entrance into module.

6. Over Fill Controls:
 - a. Provide automatic shut down of supply pumps and closure of fill valve when day tank level reaches 90% full
 - b. Provide alarm light on exterior of building on bulk tank side. Alarm light will light when day tank reaches 80% full.
- G. Heat Recovery:
 1. Provide space in the module for the future installation of jacket water waste heat equipment for each generator.
 2. Waste heat equipment for each generator may include a plate-and-frame heat exchanger, jacket water booster inline pump, and Evacuation Center distribution pump.
- H. Fire Suppression: No fire suppression system is to be provided.
- I. Sound Attenuation
 1. Provide sound insulation within the module walls, floors, and ceilings to maintain an exterior “mechanical” noise level that is 25dBA lower minimum, than interior “mechanical” noise level at 7 Meters (23 feet).
- J. Accessibility:
 1. Module shall include minimum of 7’6” headroom above finished floor.
 2. Module shall include doors or removable panels of sufficient size to allow removal of the engine or generator in one piece with the exception that small peripheral equipment may be removed to facilitate removal of the engine or generator.
- K. Lighting:
 1. Provide minimum 30 foot candles (fc) lighting level in module. Fixtures shall be Fluorescent, Metal Halide, or High Pressure Sodium type and shall be equipped with ballasts rated to -35 F.
 2. Provide wall switch with occupancy sensor for interior lighting.
 3. Provide wall fixture on exterior of module mounted above access door with photocell control.
 4. Provide one 100 watt, minimum, HPS fixture mounted on module at 12’0” AFG aimed at fuel tank fill location. Provide structural support for fixture capable of withstanding maximum wind loading for area.
- L. Electrical Distribution:
 1. Gen-1 module shall be equipped with a 100A, 240/120V, Single-phase, 3-wire, 3-pole transfer switch with switched grounded circuit conductor and

- panelboard with sufficient capacity and branch circuit breakers for loads shown on panel schedule GP-1.
2. Gen-1 module shall be equipped with a locking type 50A 3-pole, 4-wire, grounding male equipment base mounted in a weatherproof junction box on the south exterior wall of the module at 4'0" AFG for Gen-3 connection. Include matching female cord end on 25' cord with nema 114-30 make cord end for connection to gen-3.
 3. Gen-2 module shall be equipped with a 100A, 240/120V, Single-phase, 3-wire panelboard with sufficient capacity and branch circuit breakers for loads shown on panel schedule GP-2.
 4. Branch circuits for equipment shall be installed in conduit or other suitable metallic raceway.
 5. Ground and bond electrical equipment and engine generator in module in accordance with NFPA 70 requirements and the project Specifications.
 6. Module shall include two interior GFCI Protected duplex receptacles in addition to any other receptacles identified for equipment.
 7. Module shall include one GFCI protected receptacle in weatherproof enclosure on exterior of module on fuel tank side.

2.03 GASOLINE ENGINE GENERATORS

A. Acceptable Manufacturers:

1. Generac
2. Kohler
3. Substitutions: Under provisions of Division 1 and Division 16.

B. Typical Construction:

1. Frame mounted portable generator with wheels and handles.
2. Nominal dimensions:
 - a. Length = 32"
 - b. Width = 26"
 - c. Height = 28"
 - d. Weight = 250lbs dry

C. Generator Set Characteristics:

1. 8kW/10kW Peak.
2. 120/240V AC output.
3. 60Hz.

4. Control panel.
 5. Off/On/Start switch.
 6. Fuel cut-off switch.
 7. Choke.
 8. Hour Meter.
 9. Watt meter.
 10. Two 20A circuit breakers.
 11. One 2-pole 30A circuit breaker
 12. Two NEMA 5-20R GFCI protected duplex receptacles
 13. One NEMA L14-30R receptacle
- D. Engine:
1. Starting method: Electric/Manual
 2. 3600RPM
 3. Oil lubricated
- E. Safety Devices: Low oil shutdown.
- F. Cooling Equipment: Air Cooled.
- G. Fuel System:
1. Capacity: Nine gallons regular unleaded gasoline.
 2. Approximate Run Time: 6 hours at 75% load.
- H. Automatic Starting Systems: 12 volt DC.

PART 3 - EXECUTION

3.01 COORDINATION

- A. Coordinate with ventilation, control system, fuel supply and exhaust to provide an efficient and well-coordinated layout.
- B. Coordinate Work under provisions of Division 1 and Division 16.

3.02 INSTALLATION

- A. Provide each unit complete and make operational.
- B. Pitch each silencer so condensation drains away from engine.
- C. Provide draincock from low point of each silencer for periodic draining of muffler. Coordinate with Division 15: Mechanical.
- D. Install each engine at sufficient height and with appurtenances so arranged to permit dropping oil pan without removing unit from base.

- E. Provide vibration isolation (housed spring assemblies) of unit base and all fuel and exhaust equipment to prevent transfer of vibration from the engine-generator units to other equipment or to building. Provide flexible connections to radiators for piping and ductwork.
- F. Provide snubbers, braces, supports, connections, mounts, etc. for seismic loads as indicated on the structural drawings.

3.03 WIRING AND CONNECTIONS

- A. Provide conduit, wiring and connections required and recommended by unit supplier.
- B. Provide all wiring in conduit.
- C. Provide dry contacts to open outside air louver and turn on exhaust/air circulation fans, etc. when engine starts. Coordinate with Division 15: Mechanical.
- D. Do not connect neutral point of generator and generator frame to service ground.

END OF SECTION

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SECTION 16411
ENCLOSED SWITCHES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Non-fusible Switches.
- B. Double-Pole Double-Throw Switches

1.02 RELATED SECTIONS

- A. Division 1 – General Requirements.
- B. Sections 16010 – Basic Electrical Requirements.
- C. Section 16060 – Grounding and Bonding.
- D. Section 16070 – Hangers and Supports.
- E. Section 16075 – Electrical Identification.
- F. Section 16123 – Building Wire and Cable.
- G. Section 16130 – Raceway and Boxes.
- H. Section 16235 – Engine Generators.

1.03 REFERENCES

- A. National Electrical Manufacturer's Association: NEMA KS 1 – Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
- B. National Fire Protection Association: NFPA 70 – National Electrical Code, latest adopted edition.

1.04 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70, latest adopted edition.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. or an independent testing firm, acceptable to authority having jurisdiction, as suitable for purpose specified and shown.

1.05 QUALIFICATIONS

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

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with NECA 1 - Standard Practice for Good Workmanship in Electrical Contracting.

1.07 SUBMITTALS

- A. Submit under provisions of Division 1 and Division 16.
- B. Product Data: Provide switch ratings and enclosure dimensions.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.08 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1 and Division 16.
- B. Accurately record actual location of Enclosed Switches on As-built Drawings.

1.09 PROJECT CONDITIONS

- A. Verify locations of Enclosed Switches prior to rough-in.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Division 1 and Division 16 and Section 01600.
- B. Accept switches on site. Inspect for damage.
- C. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- D. Handle in accordance with manufacturer's written instructions. Handle carefully to avoid damage to switches internal components, enclosure, and finish.

1.11 COORDINATION

- A. Coordinate Work under provisions of Division 1 and Division 16.
- B. Determine required separation between Enclosed Switches and other work.
- C. Coordinate switch locations to avoid interference with other work.

1.12 OPERATION AND MAINTENANCE DATA

- A. Submit manufacturer's operation data under provisions of Division 1 and Division 16.
- B. Submit maintenance data under provisions of Division 1 and Division 16.
- C. Include maintenance instructions for cleaning methods, cleaning materials recommended, replacement, testing and adjustment, and lubrication.

1.13 ENVIRONMENTAL REQUIREMENTS

- A. Conform to NEMA PB 2 service conditions during and after installation of switchboards.

PART 2 - PRODUCTS

2.01 NON-FUSIBLE SWITCHES

- A. Manufacturer:
 - 1. Square D Substitutions:
 - 2. Under provisions of Division 1 and Division 16.
- B. Non-fusible Switch Assemblies: NEMA KS 1, Type HD load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.
- C. Configuration:
 - 1. 240/120 V, single-phase.
 - 2. 2-pole, solid neutral with ground terminals.
 - 3. Rated for continuous duty at nameplate amperage.
 - 4. Rated for load Make/Break use.
 - 5. Amperage rating, as noted on Drawings.
- D. Enclosures: NEMA KS 1.
 - 1. Interior Dry Locations: Type 1.
 - 2. Exterior Locations: Type 3R.

2.02 DOUBLE-POLE DOUBLE-THROW SWITCHES

- A. Manufacturer:
 - 1. Square D Type 82,000 series.
 - 2. Substitutions: Under provisions of Division 1 and Division 16.
- B. Non-fusible Switch Assemblies: NEMA KS 1, Type HD load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.
- C. Configuration:
 - 1. 240/120 V, single-phase.
 - 2. 3-pole (neutral switched) with ground terminals.
 - 3. Suitable for Service Equipment.
 - 4. Rated for continuous duty at nameplate amperage.
 - 5. Rated for load Make/Break use.
 - 6. Amperage rating, as noted on Drawings.

- D. Enclosures: NEMA KS 1.
 - 1. Interior Dry Locations: Type 1.
 - 2. Exterior Locations: Type 3R.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install enclosed switches where indicated, in accordance with manufacturer's instructions.
- B. Install enclosed switches plumb. Provide supports in accordance with Section 16070.
- C. Height: 5 ft to operating handle centerline.
- D. Provide engraved plastic nameplates under the provisions of Section 16075.

3.02 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 1 and Division 16.
- B. Inspect and test each enclosed controller to NEMA ICS 2.
- C. Visual and Mechanical Inspection:
 - 1. Inspect for physical damage, proper alignment, anchorage, and grounding.
 - 2. Check proper installation and tightness of connections.

END OF SECTION

SECTION 16421
ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Manual motor starters.
- B. Magnetic motor starters.

1.02 RELATED SECTIONS

- A. Division 1 – General Requirements.
- B. Sections 16010 – Basic Electrical Requirements.
- C. Section 16060 – Grounding and Bonding.
- D. Section 16070 – Hangers and Supports.
- E. Section 16075 – Electrical Identification.
- F. Section 16123 – Building Wire and Cable.
- G. Section 16130 – Raceway and Boxes.

1.03 REFERENCES

- A. National Electrical Contractor's Association:
 - 1. NECA 1 – Standard Practices for Good Workmanship in Electrical Contracting.
- B. National Electrical Manufacturer's Association
 - 1. NEMA AB 1-2002 – Molded-Case Circuit Breakers, Molded Case Switches, and Circuit Breaker Enclosures.
 - 2. NEMA ICS 2 – Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.
 - 3. NEMA ICS 6-1993 (R2001) – Industrial Control and Systems Enclosures.
 - 4. NEMA KS 1 – Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
- C. National Fire Protection Association:
 - 1. NFPA 70 – National Electrical Code, latest adopted edition.

1.04 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70, latest adopted edition.

- B. Furnish products listed and classified by Underwriters Laboratories, Inc. or an independent testing firm, acceptable to authority having jurisdiction, as suitable for purpose specified and shown.

1.05 QUALIFICATIONS

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

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with NECA 1 - Standard Practice for Good Workmanship in Electrical Contracting.

1.07 SUBMITTALS

- A. Submit under provisions of Division 1 and Division 16.
- B. Product Data: Provide manufacturers product data showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.

1.08 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1 and Division 16.
- B. Accurately record actual size and location of Enclosed Motor Controllers on As-built Drawings.

1.09 PROJECT CONDITIONS

- A. Verify locations of Enclosed Motor Controllers prior to rough-in.

1.10 DESIGN REQUIREMENTS

- A. Enclosed motor controllers size: ANSI, IEEE, NFPA 70.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Division 1 and Division 16.
- B. Accept enclosed motor controllers on site. Inspect for damage.
- C. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- D. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to breakers internal components, enclosure, and finish.

1.12 COORDINATION

- A. Coordinate Work under provisions of Division 1 and Division 16.

- B. Determine required separation between enclosed motor controllers and other work.
- C. Coordinate controller locations to avoid interference with other work.

1.13 OPERATION AND MAINTENANCE DATA

- A. Submit manufacturer's operation and maintenance (O&M) data under provisions of Division 1 and Division 16.
- B. Include maintenance instructions for cleaning methods, cleaning materials recommended, replacement, testing and adjustment, and lubrication.

1.14 ENVIRONMENTAL REQUIREMENTS

- A. Conform to NEMA PB 2 service conditions during and after installation of controllers.

PART 2 - PRODUCTS

2.01 MANUAL CONTROLLERS

- A. Manual Motor Controller: NEMA ICS 2, AC general-purpose Class A manually operated, full-voltage controller with overload element, red pilot light, and toggle operator.
- B. Fractional Horsepower Manual Controller: NEMA ICS 2, AC general-purpose Class A manually operated, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, red pilot light, and toggle operator.
- C. Enclosure: NEMA ICS 6, Type 1.

2.02 AUTOMATIC CONTROLLERS, NOT PROVIDED WITH PACKAGED EQUIPMENT

- A. Automatic Controllers other than controllers integral to and provided with equipment.
- B. Motors under 20 horsepower: Magnetic Motor Controllers with full voltage, non-reversing starters (FVNR), NEMA ICS 2, AC general-purpose Class A magnetic controller for induction motors rated in horsepower.
- C. Coil Operating Voltage: 120 volts, 60 Hertz.
- D. Overload Relay: NEMA ICS; bimetal.
- E. Enclosure: NEMA ICS 6, Type 1.
- F. Provide overload elements based on motor and NEC requirements.

2.03 PRODUCT OPTIONS AND FEATURES

- A. Auxiliary Contacts: NEMA ICS 2, 2 each field convertible contacts in addition to seal-in contact.
- B. Cover Mounted Pilot Devices: NEMA ICS 2, heavy duty oil-tight type.

- C. Pilot Device Contacts: NEMA ICS 2, Form Z, rated A150.
- D. Push-buttons: Recessed type.
- E. Indicating Lights: LED type.
- F. Selector Switches: Rotary type, Hand-Off-Auto.
- G. Relays: NEMA ICS 2.
- H. Control Power Transformers: 120 volt secondary. Provide primary and secondary overcurrent protection and bond "neutral" leg of secondary to enclosure.

PART 3 - PART EXECUTION

3.01 INSTALLATION

- A. Install enclosed motor controllers where indicated, in accordance with manufacturer's instructions.
- B. Install enclosed motor controllers plumb. Provide supports in accordance with Section 16070.
- C. Height: 5 ft to operating handle centerline.
- D. Select and install overload heater elements in motor controllers to match installed motor characteristics.
- E. Provide engraved plastic nameplates under the provisions of Section 16075.

3.02 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 1 and Division 16.
- B. Inspect and test each enclosed controller to NEMA ICS 2.
- C. Visual and Mechanical Inspection:
 - 1. Inspect for physical damage, proper alignment, anchorage, and grounding.
 - 2. Check proper installation and tightness of connections.

END OF SECTION

SECTION 16442
PANELBOARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Branch circuit panelboards.

1.02 RELATED SECTIONS

- A. Division 1 – General Requirements.
- B. Sections 16010 – Basic Electrical Requirements.
- C. Section 16060 – Grounding and Bonding.
- D. Section 16070 – Hangers and Supports.
- E. Section 16075 – Electrical Identification.
- F. Section 16123 – Building Wire and Cable.
- G. Section 16130 – Raceway and Boxes.
- H. Section 16235 – Engine Generators.

1.03 REFERENCES

- A. National Electrical Contractor's Association: NECA 1 – Standard Practices for Good Workmanship in Electrical Contracting.
- B. National Electrical Manufacturer's Association:
 - 1. NEMA AB 1-2002 – Molded-Case Circuit Breakers, Molded Case Switches, and Circuit Breaker Enclosures.
 - 2. NEMA ICS 2 – Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.
 - 3. NEMA ICS 5-2000 – Industrial Control and Systems: Control Circuit and Pilot Devices.
 - 4. NEMA KS 1 – Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
 - 5. NEMA PB 1-2000 – Panelboards.
 - 6. NEMA PB1.1-2002 – General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.
- C. National Fire Protection Association: NFPA 70 – National Electrical Code, latest adopted edition.

1.04 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70, latest adopted edition.

- B. Furnish products listed and classified by Underwriters Laboratories, Inc. or an independent testing firm, acceptable to authority having jurisdiction, as suitable for purpose specified and shown.

1.05 QUALIFICATIONS

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

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with NECA 1 - Standard Practice for Good Workmanship in Electrical Contracting.

1.07 SUBMITTALS

- A. Submit under provisions of Division 1 and Division 16.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of all equipment and components.
- C. Manufacturer's Instructions:
 - 1. Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements.
 - 2. Include instructions for storage, handling, protection, examination, preparation, operation, and installation of product.

1.08 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1 and Division 16.
- B. Record actual locations of panelboards; indicate actual branch circuit arrangement on as-built Drawings.

1.09 PROJECT CONDITIONS

- A. Verify locations of Panelboards prior to rough-in.

1.10 DESIGN REQUIREMENTS

- A. Panelboard Size: ANSI, IEEE, NFPA 70.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Division 1 and Division 16.
- B. Accept Panelboards on site. Inspect for damage.
- C. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

- D. Handle in accordance with NEMA PB 1.1 and manufacturer's written instructions. Handle carefully to avoid damage to panelboard internal components, enclosure, and finish.

1.12 COORDINATION

- A. Coordinate Work under provisions of Division 1 and Division 16.
- B. Determine required separation between panelboards and other work.
- C. Coordinate panelboard locations to avoid interference with other work.

1.13 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 1 and Division 16.
- B. Submit manufacturer's operation and maintenance data.
- C. Include operating data for each circuit breaker type.
- D. Include maintenance instructions for cleaning methods, recommended cleaning materials, instruction for circuit breaker removal, installation, testing and adjustment for each circuit breaker type.

1.14 MAINTENANCE MATERIALS

- A. Provide maintenance materials under provisions of Division 1 and Division 16.
- B. Provide two of each panelboard key.

PART 2 - PRODUCTS

2.01 BRANCH CIRCUIT PANELBOARDS

- A. Manufacturers:
 - 1. Square D.
 - 2. Cutler Hammer.
 - 3. GE.
 - 4. Substitutions: Under provisions of Division 1 and Division 16.
- B. Lighting and Appliance Branch Circuit Panelboards: NEMA PB1, circuit breaker type.
- C. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard; provide insulated ground bus where scheduled.
- D. Minimum integrated short circuit rating: 10,000 amperes rms symmetrical for 240- volt panelboards, unless indicated otherwise on Drawings.

- E. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits and as HACR for Heating and Air Conditioning circuits.
- F. Heat Trace Circuits: Provide UL Class A ground fault interrupter circuit breakers.
- G. Do not use tandem circuit breakers.
- H. Enclosure: NEMA PB 1, Type 1.
- I. Cabinet Front: Surface cabinet front with concealed trim clamps, concealed hinge, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install panelboards in accordance with NEMA PB 1.1.
- B. Install panelboards plumb. Provide supports in accordance with Division 1 and Division 16 and Section 16070.
- C. Height: 6 ft to top of panelboard; install panelboards taller than 6 ft with bottom no more than 4 inches above floor.
- D. Provide filler plates for unused spaces in panelboards.
- E. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- F. Provide engraved nameplates under the provisions of Section 16075.

3.02 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 1 and Division 16.
- B. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other where circuiting is not installed in accordance with the design Drawings.
- C. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers.

END OF SECTION

SECTION 16510
LIGHT FIXTURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Light Fixtures and Accessories.
- B. Exit signs.
- C. Ballasts.
- D. Lamps.

1.02 RELATED SECTIONS

- A. Division 1 – General Requirements.
- B. Sections 16010 – Basic Electrical Requirements.
- C. Section 16060 – Grounding and Bonding.
- D. Section 16070 – Hangers and Supports.
- E. Section 16123 – Building Wire and Cable.
- F. Section 16130 – Raceway and Boxes.

1.03 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI C78.379-1994 (R 2004) – Classification of Beam Patterns of Reflector Lamps.
 - 2. ANSI C82.1 – Ballasts for Fluorescent Lamps — Specifications.
- B. International Building Code: IBC 2006 edition.
- C. Illuminating Engineering Society of North America: IESNA Lighting Handbook.
- D. National Electrical Manufacturer’s Association: NEMA WD 6 – Wiring Devices—Dimensional Requirements.
- E. National Fire Protection Association:
 - 1. NFPA 70 – National Electrical Code, latest adopted edition.
 - 2. NFPA 101 – Life Safety Code, latest adopted edition.

1.04 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70, latest adopted edition.
- B. Provide products listed and classified by Underwriters Laboratories, Inc. or an independent testing firm, acceptable to authority having jurisdiction, as suitable for purpose specified and shown.

1.05 QUALIFICATIONS

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

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with NECA 1 – Standard Practices for Good Workmanship in Electrical Contracting.

1.07 SUBMITTALS

- A. Submit under provisions of Division 1 and Division 16.
- B. Product Data: Provide dimensions, ratings, and performance data.

1.08 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1 and Division 16.
- B. Accurately record actual locations of each light fixture on as-built Drawings.

1.09 PROJECT CONDITIONS

- A. Verify locations of each light fixture prior to rough-in.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products under provisions of Division 1 and Division 16.
- B. Accept light fixtures on site. Inspect for damage.
- C. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

1.11 COORDINATION

- A. Coordinate Work under provisions of Division 1 and Division 16.
- B. Determine and maintain required separation between light fixtures and other work.
- C. Coordinate light fixture locations to avoid interference with other work.

1.12 EXTRA MATERIALS

- A. Furnish under provisions of Division 1 and Division 16.
- B. Provide two of each plastic lens.
- C. Provide four replacement lamps for each type lamp installed.
- D. Provide two of each ballast type.

1.13 OPERATION AND MAINTENANCE DATA

- A. Submit manufacturer's operation data under provisions of Division 1 and Division 16.
- B. Submit maintenance data under provisions of Division 1 and Division 16.
- C. Include maintenance instructions for cleaning methods, cleaning materials recommended, replacement, testing, and adjustment.

1.14 ENVIRONMENTAL REQUIREMENTS

- A. Conform to NEMA PB 2 service conditions during and after installation of light fixtures.

PART 2 - PRODUCTS

2.01 LIGHT FIXTURES

- A. Provide products as specified in schedule on Drawings.
- B. Install ballasts, lamps, and specified accessories at factory.
- C. Ballast shall be formulated specifically for the lamps contained in the fixture.

2.02 EXIT SIGNS

- A. Manufacturer: Access Products, Inc. , 241 Main St., Suite 100, Buffalo NY 14203
- B. Description: UL 924 Listed, meeting NFPA 101 requirements for non-electric photo-luminescent type, exit sign fixture as specified in schedule on Drawings.

2.03 BALLASTS

- A. Fluorescent Ballast:
 - 1. Provide ballast furnished with light fixture and suitable for lamps specified.
 - 2. Voltage: Match luminaire voltage.
 - 3. Source Quality Control: Certify ballast design and construction by Certified Ballast Manufacturers, Inc.

2.04 LAMPS

- A. Incandescent Lamp Manufacturers:
 - 1. General Electric.
 - 2. Phillips.
 - 3. Sylvania.
 - 4. Substitutions: Under provisions of Division 1 and Division 16.
- B. Fluorescent Lamp Manufacturers:

1. General Electric.
 2. Phillips.
 3. Sylvania.
 4. Substitutions: Under provisions of Division 1 and Division 16.
- C. Provide lamp type specified for light fixture.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrate and supporting grids for light fixtures.
- B. Examine each luminaire to determine suitability for lamps specified.

3.02 INSTALLATION

- A. Provide in accordance with manufacturers instructions.
- B. Provide suspended light fixtures and exit signs using pendants supported from swivel hangers or other method as furnished with the light fixture. Provide pendant length required to suspend luminaire at indicated height.
- C. Locate recessed ceiling light fixtures as indicated on the Drawings, coordinate light fixture locations in grid ceilings with lay in panels with architectural reflected ceiling plan.
- D. Provide surface mounted light fixtures and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.
- E. Provide recessed light fixtures to permit removal from below.
- F. Provide recessed light fixtures using accessories and fire stopping materials to meet regulatory requirements for fire rating.
- G. Provide clips to secure recessed grid supported light fixtures in place.
- H. Provide wall mounted light fixtures, emergency lighting units, and exit signs at heights indicated on Drawings.
- I. Provide accessories furnished with each luminaire.
- J. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- K. Bond products and metal accessories to branch circuit equipment grounding conductor.
- L. Provide specified lamps in each luminaire.
- M. Tandem wiring of ballast is not permitted.

3.03 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.
- B. Replace light fixtures not operating properly and all defective light fixtures at substantial completion.

3.04 ADJUSTING

- A. Adjust Work under provisions of Division 1 and Division 16.
- B. Re-lamp light fixtures that have failed lamps or lamps with over 200 hours total operating time no more than 48 hours prior to Date of Substantial Completion Observation.

3.05 CLEANING

- A. Clean Work under provisions of Division 1 and Division 16.
- B. Clean electrical parts to remove conductive and deleterious materials.
- C. Remove dirt and debris from enclosure.
- D. Clean photometric control surfaces as recommended by manufacturer.
- E. Clean finishes and touch-up damage.

3.06 DEMONSTRATION

- A. Provide systems demonstration under provisions of Division 1 and Division 16.
- B. Provide minimum of one hour demonstration of luminaire operation include "walking tour" noting all switch types and locations.

END OF SECTION

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