

**SECTION 02 4119
SELECT DEMOLITION**

PART 1 - GENERAL

1.01 REFERENCE STANDARDS AND 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. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.
 - 2. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
 - 3. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
 - 4. All materials, installation and workmanship shall comply with all applicable requirements and standards.

1.02 SUBMITTALS

- A. Record Documents:
 - 1. Schedule indicating proposed sequence of operations for selective demolition Work to Owner's Representative for review prior to start of Work. Include coordination for shutoff, capping, and continuation of utility services as required, together with details for dust and noise control protection.
 - 2. Provide detailed sequence of demolition and removal Work to ensure uninterrupted progress of Owner's on-site operations.
 - 3. Photographs of existing conditions of structure surfaces, equipment, and adjacent improvements that might be misconstrued as damage related to removal operations. File with Owner's Representative prior to start of Work.
 - 4. Coordinate with Owner's continuing occupation of portions of existing building and with Owner's partial occupancy of completed project.

1.03 PROJECT CONDITIONS

- A. Owner will occupy portions of the building immediately adjacent to areas of selective demolition.
 - 1. Conduct selective demolition Work in manner that will minimize need for disruption of Owner's normal operations. Provide minimum of 72 hours advance notice to Owner of demolition activities that will affect Owner's normal operations.
 - 2. Coordinate with Owner's continuing occupation of portions of existing building and with Owner's partial occupancy of completed project.
 - 3. Owner assumes no responsibility for actual condition of items or structures to be demolished.
- B. Conditions existing at time of inspection for bidding purposes will be maintained by Owner insofar as practicable. However, minor variations within structure may occur by Owner's removal and salvage operations prior to start of selective demolition Work.

- C. Promptly repair damages caused to adjacent facilities by demolition Work.
- D. Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.
 - 1. Do not close, block, or otherwise obstruct streets, walks, or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
- E. Do not use cutting torches for removal until Work area is cleared of flammable materials. At concealed spaces, such as interior of ducts and pipe spaces, verify condition of hidden space before starting flame cutting operations. Maintain portable fire suppression devices during flame cutting operations.
- F. Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.
 - 1. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.
 - 2. Maintain fire protection services during selective demolition operations.
- G. Use water sprinkling, temporary enclosures, and other methods to limit dust and dirt migration.
 - 1. Comply with governing regulations pertaining to environmental protection.
 - 2. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.02 MATERIAL OWNERSHIP

- A. Except for items or materials indicated to be reused, salvaged, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the Site with further disposition of the Contractor's option.
- B. Historical items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to the Owner, which may be encountered during demolition, remain the Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to the Owner.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of areas to be demolished and adjacent facilities to remain.
- B. Cease operations and notify Owner's Representative immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.
- C. Locate, identify, stub off, and disconnect utility services that are not indicated to remain.

1. Provide bypass connections as necessary to maintain continuity of service to occupied areas of building.
2. Provide minimum of 72 hours advance notice to Owner if shutdown of service is necessary during changeover.

3.02 INSTALLATION

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- B. All installation shall be in accordance with manufacturer's published recommendations.

3.03 DEMOLITION

- A. Perform selective demolition Work in a systematic manner. Use such methods as required to complete Work indicated on Drawings in accordance with demolition schedule and governing regulations.
 1. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power driven masonry saw or hand tools; do not use power driven impact tools.
 2. Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors, or framing.
 3. Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.
 4. Demolish foundation walls to a depth of not less than 12 inches below existing ground surface. Demolish and remove below grade wood or metal construction. Break up below grade concrete slabs.
 5. For interior slabs on grade, use removal methods that will not crack or structurally disturb adjacent slabs or partitions. Use wet power saw to minimize dust production.
 6. If unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Owner's Representative in written, accurate detail. Pending receipt of directive from Owner's Representative, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.

3.04 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove from building Site debris, rubbish, and other materials resulting from demolition operations. Transport and legally dispose off Site.
- B. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.
- C. Burning of removed materials is not permitted on the Project Site.

3.05 CLEANUP AND REPAIR

- A. Upon completion of demolition Work, remove tools, equipment, and demolished materials from the Project Site.
- B. Remove protections and leave interior areas broom clean.
- C. Repair demolition performed in excess of that required.

- D. Return elements of construction and surfaces to remain to condition existing prior to start operations.
- E. Repair adjacent construction or surfaces soiled or damaged by selective demolition Work.

END OF SECTION 02 4119

SECTION 03 3000
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Cast-in-place concrete, cement, aggregates, water and admixtures.
- B. Proportioning, mixing, conveying, placing, finishing, curing, and testing of cast-in-place concrete.
- C. Installation of concrete accessories for cast-in-place concrete.
- D. Coordinate installation of embedded items furnished and installed under other sections.

1.02 REFERENCES

- A. ACI 214 - Recommended Practice for Evaluation of Strength Test Results of Concrete.
- B. ACI 301 - Specifications for Structural Concrete for Buildings
- C. ACI 304 - Guide for Measuring, Mixing, Transporting and Placing Concrete
- D. ACI 309 - Guide for Consolidation of Concrete
- E. ACI 318 - Building Code Requirements for Structural Concrete

1.03 QUALITY ASSURANCE

- A. Use plant mixed concrete mixed in stationary mixers.
- B. Truck mixed concrete is allowed provided procedures in ASTM C94 are followed and documented.
- C. Mix and deliver concrete in accordance with ASTM C94.
- D. Perform concrete work in accordance with ACI 318, unless specified otherwise.
- E. Obtain materials from same source throughout work.
- F. Qualifications
 - 1. Work shall be performed by a company regularly engaged in the installation of refrigerated concrete floor and the application of concrete materials. Provide proof that the contractor has successfully completed at least three (3) projects of similar size and complexity in the past five (5) years.
 - 2. Concrete slab work shall be performed by an established concrete floor finishing contractor with a proven track record of satisfactory, consistent quality workmanship for a period of a minimum five years related to refrigerated floor slab and other stringent floor tolerance specified concrete floor slabs. Floor finishing contractor must have successfully performed a minimum of twenty-five refrigerated slabs utilizing specialized mechanical laser-guided power screed equipment. Approved contractor must show proof of this requirement to the consultant in advance of issuing contract.

1.04 CONCRETE TESTING SERVICE

- A. Employ and pay for services of independent testing laboratory (ITL), experienced in testing

and design of concrete materials and mixtures, to perform materials evaluation tests on proposed aggregates, to design and test new proposed concrete mixes, to perform field tests of concrete during placement and to perform laboratory tests on concrete test cylinders. ITL shall meet requirements of ASTM E329. Selection of ITL is subject to Engineer's and Owner's acceptance.

- B. Provide testing of newly constructed concrete hockey rink floor for flatness and levelness. Tests shall be performed by an ACt certified technician employed either by the Contractor or an ITL.

1.05 SUBMITTALS

- A. Submit mix design for concrete used in ice rink floor. Proportion designs in accordance with "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318.
- B. Provide mix design containing the following information:
 - 1. Design strength
 - 2. Slump
 - 3. Air content
 - 4. Unit weight
 - 5. Water/cement ratio
- C. Mix ingredients including quantities, ASTM designations, and sources for:
 - 1. Cementitious materials including fly ash
 - 2. Coarse and fine aggregates
 - 3. Water (potable City water is acceptable)
 - 4. Types and amounts of admixtures (including manufacturer)
- D. Test results:
 - 1. Compressive strength results of trial batches or historical test data
 - 2. Statistical computations showing required average strength of mix
 - 3. Unit weight
 - 4. Slump
 - 5. Water/cementitious ratio of mix
 - 6. Air content
- E. Provide test results to Engineer within five (5) days of concrete placement.
 - 1. Hockey Rink Floor Flatness and Levelness Testing

PART 2—PRODUCTS

2.01 CONCRETE

- A. General Requirements
 - 1. All concrete shall be provided by an Iowa Department of Transportation (Iowa DOT) certified source. Provide written verification of certification.

2. Coarse Aggregates
 - a. Iowa Standard Specification 4115 (Coarse Aggregate for Concrete) applies.
 - b. Gradation: Standard Specification 4104, Gradation No. 5 for D-67 concrete stone.
 3. Fine Aggregate
 - a. Iowa DOT Standard Specification 4110 (Fine Aggregate for Concrete) applies.
 - b. Gradation: Standard Specification 4109, Gradation No. 1.
 4. Cementitious Materials
 - a. Type 1 cement
 - b. Fly ash (Type C only) and slag may be used in accordance with Iowa DOT Standard Specifications.
- B. Design Requirements
1. Minimum Compressive Strength = 5,000 PSI
 2. Air Content = 3% - 5%
 3. Slump
 - a. Minimum = 1-inch
 - b. Maximum = 4-inches (except when super plasticizer is used)
 4. Mix must be pumpable.
- C. Admixtures: Admixtures shall conform to ASTM C494 or ASTM C260 and shall not contain chlorides or thiocyanates.
1. Water Reducing Admixtures: ASTM C494, Type A. Add to concrete in accordance with manufacturer's instructions. Eucon WR-75 by Euclid Chemical, Possolith 220N by Master Builders, Plastocrete 160 by Sika Chemical, Prokrete N by Protex Industries, or WRDA by Grace Construction Products.
 2. Water Reducing, Retarding Admixture: ASTM C494, Type D. Pozzolith 100XR by Master Builders, Plastiment by Sika Chemical, Eucon Retarder-75 by Euclid Chemical, Protard by Protex Industries or Duratard 17 by Grace Construction Products.
 3. High Range Water Reducing Admixture (Superplasticizer): ASTM C494, Type F or G. Sikament by Sika Chemical, Eucon 37 by Euclid Chemical, WRDA or Daracem 100 by Grace Construction Products.
 4. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E, Accelguard 80 by Euclid Chemical, or Daraset by Grace Construction Products.
 5. Air-Entraining Admixtures: ASTM C260. Where required air contents are specified, add in accordance with manufacturer's instructions. Ad mixtures shall be in accordance with Iowa DOT Instructional Memorandum 1M403.
 6. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures effectively containing chloride ions (more than 0.05 percent) are not permitted.
- D. Perimeter Expansion Joint Material
1. Rigid Insulation Board: Owens-Corning Formular 250 or approved equal, 1-inch width,

2.5-inch nominal depth.

2. Pavement Seal: D.S. Brown Type V-400 or approved equal, 1-inch width, 2.5-inch nominal depth.
3. Total depth of above materials = 5-inches.

E. Reinforcement

1. Reinforcing steel shall be Grade 60 conforming to ASTM A615, A616 or A617. Epoxy coating is not required.
2. Welded wire steel fabric shall be electrically welded steel mesh.
 - a. Mesh size 6-inch by 6-inch
 - b. Wire gauge = all wires 6 gauge (0.1620 inch AWG)
3. Wire ties

PART 3 - EXECUTION

3.01 PLACING CONCRETE

- A. Place concrete in accordance with ACI 301. Consolidate concrete in accordance with ACI 309 using high frequency vibrators.
- B. Place concrete in accordance with ACI 301. Consolidate concrete in accordance with ACI 309 using high frequency vibrators.
- C. Clean forms, reinforcing and accessories and dampen forms immediately prior to placing concrete.
- D. Schedule concrete deliveries to ensure each load is placed within 90 minutes after mixing water is added.
- E. Deposit concrete as near as practicable to its final position to avoid segregation due to rehandling or flowing, in layers not exceeding 12 inch in depth, and compact each layer with vibrators.
- F. Do not allow concrete to fall freely more than 4 feet. Use tremies, chutes or elephant trunks where necessary.
- G. Do not use concrete that has partially hardened or been contaminated by foreign materials, nor concrete that has been retempered or remixed after initial set.
- H. Continue concrete work uninterrupted until completion of run so no concrete is placed against concrete that has attained its initial set, except at construction joints.
- I. Before depositing new concrete on or against concrete that has set at construction joints, clean, wet and apply near cement slurry to existing surfaces. Tighten forms prior to resuming pouring.
- J. Exercise care to prevent splashing of forms or reinforcing with concrete above level of concrete being placed.
- K. Clean reinforcement projecting above or out of concrete immediately after completion of particular unit of pour.
- L. Do not place concrete under adverse weather conditions unless adequate protection is provided. Refer to ACI 301, for weather restrictions and placing temperatures.

- M. Conform to ACI 306 when concreting during cold weather. When heating, do not allow carbonation to occur.
- N. Exercise care during hot weather to keep concrete temperatures and mixing and placing time to minimum. Dispatch transport trucks to avoid delays and organize work to use concrete promptly.
- O. Conform to ACI 305 when concreting during hot weather including avoidance of alkali reactions to hardened surface. Maintain maximum concrete temperature of 90 degrees F. prior to placing.
- P. Before placing concrete slabs on grade, sprinkle base sufficiently to eliminate suction of water from concrete, but there shall not be any free standing water present. Place moisture barrier directly on subgrade material prior to placing granular base at interior slabs on grade.

3.02 CONTRACTION AND EXPANSION JOINTS

- A. Concrete pavement for the refrigerated concrete hockey rink floor shall be a continuous operation. Unless otherwise noted, no pre-fabricated or sawn construction joints shall be required or allowed.
- B. Provide construction joints only when stoppage of concreting operations occurs.
- C. Continue reinforcing steel across construction joints unless noted or detailed otherwise.
- D. Place perimeter expansion joint as detailed in drawings.

3.03 FINISHING

- A. Finish concrete floor hockey rink so concrete surface is level with perimeter concrete.
- B. Set screeds by instruments with firm, stable supports, but not mortar mounds. Place concrete to accurate screeds, with screed lines filled.
- C. Start finishing when concrete has hardened sufficiently to permit use of mechanical rotary finisher. Finishing machines shall thoroughly compact and level concrete, using 2 to 4 passes of machine.
- D. Final finish with steel trowel or floats.
- E. Provide finished surface free of trowel marks with a uniform texture and appearance.
- F. Tolerances
 - 1. Flatness: FF 40
 - 2. Levelness: FL 25

3.04 MISCELLANEOUS CONCRETE ITEMS

- A. Provide miscellaneous concrete items as noted and detailed on drawings.
- B. Provide and install reinforcing, anchors and bolts in concrete where directed and required.
- C. Provide for installation of inserts, hangers, metal ties and other fastening devices required for attachment of other work.
- D. Properly locate fastening devices in cooperation with other trades and secure in position before concrete is placed.

3.05 REPAIR OF SURFACE DEFECTS AND PATCHING

- A. If objectionable air holes, honeycombed areas or other surface defects occur, as determined by Engineer, repair defects in accordance with ACI 301, unless other materials and methods are permitted by Engineer.
- B. At unexposed surfaces fill tie holes in accordance with ACI 301.
- C. At exposed surfaces any patching required and permitted, as determined by Engineer, shall comply with ACI 301.
- D. At exposed surfaces plugging of tie holes, blemish repairs and removal of stains shall be performed as described in ACI 301. Engineer will select materials and methods for plugging of tie holes from alternates described therein.
- E. Concrete containing unrepairable surface defects or that cannot be patched to produce required finished, or exceed permissible tolerances as determined by Engineer, shall be removed and replaced.
- F. Patch existing concrete where noted and where affected by new construction as required to match existing concrete.

3.06 CURING AND PROTECTION

- A. Provide wet burlap curing and protection immediately after placement in accordance with ACI 301.
- B. Continue curing and protection period as required by ACI 301. Cure not less than 14 days for all concrete.
- C. Provide continuous wet burlap curing with no dryouts during entire period.
- D. After 14 days, remove burlap covering and allow slab to cure dry for additional 14 days. Total cure time is 28 days.

3.07 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. Coordinate with Independent Testing Laboratory (ITL) to make, cure and determine strength of concrete test cylinders cast in field. Evaluation and acceptance of concrete shall be in accordance with ACI 318.
- B. ITL shall submit copies of test results to Owner, Engineer and Contractor as soon as practicable after they are made.

3.08 EVALUATION OF TEST RESULTS AND FAILURE TO MEET STRENGTH REQUIREMENTS

- A. Test results: Evaluate in accordance with ACI 214.
- B. Evaluations shall be valid only if samples have been taken and tests have been conducted in accordance with ACI and ASTM specifications and methods as applicable.
- C. If strength test performed on concrete cylinders, cast at time concrete is placed, fail to meet specified 28 day values, or if samples have not been taken and tests conducted as specified, concrete represented by such samples and test shall be considered questionable and shall be subject to further testing at expense of Contractor.
- D. These additional tests of questionable concrete shall be performed by Independent Testing Laboratory, acceptable to Engineer, and shall be conducted in accordance with ASTM C42. Concrete cores may be obtained in field, or load tests conducted and results evaluated in accordance with ACI 318.

- E. Test results obtained by use of impact hammer or sonoscope, unless correlated with other data, will not be considered conclusive in evaluating strengths of concrete.
- F. If additional testing fails to demonstrate strengths adequate for intended purpose of member or members in questions, as determined by Engineer, remove questionable concrete and replace with concrete meeting specifications.

END OF SECTION 23000

SECTION 07 2100

INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

1.02 REFERENCE STANDARDS

- A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
- C. All materials, installation and workmanship shall comply with all applicable requirements and standards.
- D. Definitions:
 - 1. Thermal Resistivity: Where the thermal resistivity of insulation products is designated by "r values," they represent the reciprocal of thermal conductivity (k values). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivities are expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one square foot per hour at mean temperatures indicated.

1.03 QUALITY ASSURANCE

- A. Single Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

1.04 SUBMITTALS

- A. Product Data:
 - 1. Submit a complete listing of all manufacturers, products, model numbers, and designs proposed for use in the Work of this Section.
 - 2. Include code compliance verification, R-values, moisture permeability, fire ratings and installation instructions.
- B. Record Documents:
 - 1. Maintain two copies of all shop drawings, product data, and samples, manufacturer's specifications, recommendations, installation instructions, and maintenance data at the Project Site.
 - 2. At Project Closeout, turn over both copies to the Architect who will transmit one copy to the Owner.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location.
- B. Comply with manufacturer's recommendations for handling, storage, and protection during installation.
- C. Protect plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver plastic insulating materials to the Project Site ahead of installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.02 INSULATING MATERIALS

- A. Extruded Polystyrene Board Insulation: Rigid, cellular polystyrene thermal insulation with closed cells and integral high density skin, formed by the expansion of polystyrene base resin in an extrusion process to comply with ASTM C 578 for type indicated; with 5 year aged r values of 5.4 and 5 at 40 and 75 degrees F (4.4 and 23.9 degrees C), respectively.
 1. Extruded Polystyrene Board Insulation Type
 - a. Type IV, 1.6 pcf min. density, unless otherwise indicated.
 - b. Type V, 3.0 pcf min. density where indicated.
 - c. Type VI, 1.8 pcf min. density.
 - d. Type VII, 2.2 pcf min. density.
 - e. Type X, 1.35 pcf min. density.
 2. Manufacturers:
 - a. Tenneco Building Products Co.
 - b. DiversiFoam Products.
 - c. Dow: The Dow Chemical Company.
 - d. UC Industries, Inc.
- B. Unfaced, Flexible Glass Fiber Board Insulation: Thermal insulation produced by combining glass fibers with thermosetting resin binders to comply with ASTM C 553, Class B 4, and ASTM C 612, Class 1; with nominal density of not less than 1.5 nor more than 1.65 pcf, r value of 4.13 at 75 degrees F (23.9 degrees C), and maximum flame spread and smoke developed values of 25 and 50, respectively.
 1. Products:
 - a. CertainTeed "WP 165".
 - b. Knauf "IB 1.6".
 - c. Schuller "Insul-Shield 150"
 - d. Owens Corning "701".

VAPOR RETARDERS

- A. Reinforced Polyethylene Vapor Retarder: Multiple layers of polyethylene film reinforced with inner layers of nylon cord reinforcing and laminated together with a rubber adhesive to produce the following product in roll form:
 1. Tape for Vapor Retarder: Pressure sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.
 2. Reinforced Polyethylene Vapor Retarder:
 - a. "Griffolyn T 65," Griffolyn Div., Reef Industries, Inc.

- b. "Alumiseal Zero Perm," Alumiseal Corp.

2.03 AUXILIARY INSULATING MATERIALS

- A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation or mechanical anchors securely to substrates indicated without damaging or corroding either insulation, anchors, or substrates.
- B. Eave Ventilation Troughs: Preformed rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Examine substrates and conditions with Installer present, for compliance with requirements of the Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.
- B. Clean substrates of substances harmful to insulations or vapor retarders, including removal of projections that might puncture vapor retarders.
- C. Close off openings in cavities receiving poured in place insulation to prevent the escape of insulation. Provide bronze or stainless steel screen (inside) where openings must be maintained for drainage or ventilation.

3.02 INSTALLATION

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- B. All installation shall be in accordance with manufacturer's published recommendations.

3.03 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Apply insulation units to substrate by method indicated, complying with manufacturer's recommendations. 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. Where insulation units are not held tightly in place by adjacent materials on all sides, provide wire ties or other acceptable mechanical means to prevent displacement or sagging of insulation.
- C. Extend insulation full thickness as indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections that interfere with placement.
- D. Apply a single layer of insulation of required thickness, unless otherwise shown or required to make up total thickness.
- E. Seal joints between closed cell (nonbreathing) insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
- F. Set vapor retarder faced units with vapor retarder to warm side of construction, except as otherwise indicated. Do not obstruct ventilation spaces.
- G. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
- H. Place glass fiber loose fill insulation into spaces and onto surfaces as shown, either by pouring or by machine blowing. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not excessively compact.
- I. Stuff glass fiber loose fill insulation into miscellaneous voids and cavity spaces where shown. Compact to approximately 40 percent of normal maximum volume (to a density of approximately

2.5 pcf).

3.04 INSTALLATION OF PERIMETER AND UNDER SLAB INSULATION

- A. On vertical surfaces, set units in adhesive applied in accordance with manufacturer's instructions. Use type of adhesive recommended by manufacturer of insulation.
- B. Protect below grade insulation on vertical surfaces (from damage during back filling) by application of protection board. Set in adhesive in accordance with recommendations of manufacturer of insulation.
- C. Protect top surface of horizontal insulation (from damage during concrete work) by application of protection board.

3.05 INSTALLATION OF VAPOR RETARDERS

- A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose fiber insulation.
- B. Seal vertical joints in vapor retarders over framing by lapping not less than 2 wall studs. Fasten vapor retarders to framing at top, end, and bottom edges, at perimeter of wall openings, and at lap joints; space fasteners 16 inches on center.
- C. Seal overlapping joints in vapor retarders with adhesives or tape per vapor retarder manufacturer's printed directions. Seal butt joints and fastener penetrations with tape of type recommended by vapor retarder manufacturer. Locate all joints over framing members or other solid substrates.
- D. Firmly attach vapor retarders to substrates with mechanical fasteners or adhesives as recommended by vapor retarder manufacturer.
- E. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with tape of type recommended by vapor retarder manufacturer to create an airtight seal between penetrating objects and vapor retarder.
- F. Repair any tears or punctures in vapor retarders immediately before concealment by other work. Cover with tape or another layer of vapor retarder.

3.06 PROTECTION

- A. General: Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes.
- B. Provide temporary coverings or enclosures where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 07 9005

JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sealants and joint backing.
- B. Precompressed foam sealers.

1.02 RELATED SECTIONS

- A. Section 03 3000 - Concrete: Concrete Paving Joint Sealant.
- B. Section 08 1100 - Steel Doors and Frames: Joint Sealant at Frames

1.03 REFERENCES

- A. ASTM C 834 - Standard Specification for Latex Sealants.
- B. ASTM C 919 - Standard Practice for Use of Sealants in Acoustical Applications.
- C. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants.
- D. ASTM C 1193 - Standard Guide for Use of Joint Sealants.
- E. ASTM D 1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber.
- F. ASTM D 1667 - Standard Specification for Flexible Cellular Materials--Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.
- C. Samples: Submit two samples, 1/4 x 2 inch in size illustrating sealant colors for selection.
- D. Manufacturer's Installation Instructions: Indicate special procedures.

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.06 COORDINATION

- A. Coordinate the work with all sections referencing this section.

1.07 WARRANTY.

- A. Correct defective work within a five year period after Date of Substantial Completion.
- B. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 SEALANTS

- A. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by the more stringent of the South Coast Air Quality Management District Rule No.1168.
- B. General Purpose Exterior Sealant: Polyurethane; ASTM C 920, Grade NS, Class 25, Uses M, G, and A; multi-component.
 - 1. Color: Standard colors matching finished surfaces.
 - 2. Acceptable products:
 - a. Product: "NP 2" manufactured by Sonneborn Building Products.
 - b. Product: "DYmeric" 511 manufactured by Tremco Incorporated.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
 - 3. Applications: Use for:
 - a. Control, expansion, and soft joints in masonry.
 - b. Joints between concrete and other materials.
 - c. Joints between metal frames and other materials.
 - d. Sealing under thresholds at exterior doors.
 - e. Other exterior joints for which no other sealant is indicated.
- C. Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, nondrying, nonskinning, noncuring.
 - 1. Acceptable products:
 - a. Product: "Tremco 440 Tape" manufactured by Tremco Incorporated.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
 - 2. Applications: Use for:
 - a. Non-compression glazing of vision lights in metal frames.
 - b. Concealed sealant bead in sheet metal work.
- D. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C 834, Type OP, Grade NF single component, paintable.
 - 1. Color: Standard colors matching finished surfaces.
 - 2. Acceptable products:
 - a. Product: "Tremflex" 834 manufactured by Tremco Incorporated.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
 - 3. Applications: Use for:
 - a. Interior wall and ceiling control joints.
 - b. Joints between door and window frames and wall surfaces.
 - c. Other interior joints for which no other type of sealant is indicated.
- E. Concrete Paving Joint Sealant: Polyurethane, self-leveling; ASTM C 920, Class 25, Uses T, I, M and A; single component.
 - 1. Color: Limestone.
 - 2. Product:
 - a. "Vulkem 45SSL" manufactured by Tremco Incorporated.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
 - 3. Applications: Use for:
 - a. Joints in sidewalks and vehicular paving.
- F. Silicone Sealant: ASTM C 920, Grade NS, Class 25, Uses NT, A, G, M, O; single component, neutral curing, non-sagging, non-staining, fungus resistant, non-bleeding.
 - 1. Color: Standard colors matching finished surfaces.
 - 2. Acceptable products:
 - a. Product: "Dow Corning 795" Silicone Building Sealant manufactured by Dow Silicones Corporation.
 - b. Product: "Spectrem 2" manufactured by Tremco Incorporated.

- c. Substitutions: See Section 01 6000 - Product Requirements.
- 3. Movement Capability: Plus and minus 50 percent.
- 4. Service Temperature Range: -65 to 180 degrees F.
- 5. Shore A Hardness Range: 15 to 35.
- 6. Applications: Use for:
 - a. Structural and nonstructural glazing of glass, metal and plastic..
 - b. Weatherproofing perimeter joints around metal frames.

2.02 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1056, sponge or expanded rubber; oversized 30 to 50 percent larger than joint width.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

- A. Remove loose materials and foreign matter which might impair adhesion of sealant.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C 1193.
- D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C 1193.
- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.
- D. Install bond breaker where joint backing is not used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- G. 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.
- I. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch below adjoining surface.

3.04 CLEANING

- A. Clean adjacent soiled surfaces.

3.05 PROTECTION OF FINISHED WORK

- A. Protect sealants until cured.

END OF SECTION

SECTION 08 1100
STEEL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Steel doors and frames.
- B. Steel window frames.

1.02 RELATED SECTIONS

- A. Section 08 7120 - Door Hardware.
- B. Section 09 9000 - Paints and Coatings: Field painting.

1.03 REFERENCES

- A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 1998.
- B. ANSI A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames; 2003.
- C. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 1998.
- D. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2004a.
- E. DHI A115 Series - Specifications for Steel Doors and Frame Preparation for Hardware; Door and Hardware Institute; 2000 (ANSI/DHI A115 Series).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.
- D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

1.05 QUALITY ASSURANCE

- A. Maintain at the project site a copy of all reference standards dealing with installation.

PART 2 PRODUCTS

2.01 DOORS AND FRAMES

- A. Requirements for All Doors and Frames:
 - 1. Hardware Preparation: In accordance with DHI A115 Series, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
 - 2. Door Top Closures: Flush with top of faces and edges.

3. Door Edge Profile: Beveled on both edges.
 4. Door Texture: Smooth faces.
 5. Finish: Factory primed, for field finishing.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.02 STEEL DOORS

- A. Interior Doors, Non-Fire-Rated:
1. Grade: ANSI A250.8 Level 2, physical performance Level B, Model 1, full flush.
 2. Core: Cardboard honeycomb or polystyrene foam.
 3. Thickness: 1-3/4 inches.

2.03 STEEL FRAMES

- A. General:
1. Comply with the requirements of grade specified for corresponding door.
 - a. Interior Level 2 Doors: 16 gage frames.
 2. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A 653/A 653M, with manufacturer's standard coating thickness.
 3. Finish: Factory primed, for field finishing.
- B. Interior Door Frames, Non-Fire-Rated: Fully welded type.
- C. Frames for Interior Glazing or Borrowed Lights: Construction and face dimensions to match as indicated on drawings.

2.04 ACCESSORY MATERIALS

- A. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
- B. Grout for Frames installed in walls:
1. Coat interior of frame's surface with bituminous coating.
 2. Grout hollow metal frame solid. Provide Portland cement grout of maximum 3-inch slump for hand troweling; thinner pumpable grout is prohibited.
- C. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.

2.05 FINISH MATERIALS

- A. Primer: Rust-inhibiting, complying with ANSI A250.10, door manufacturer's standard.
- B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

2.06 STEEL FRAMES FOR DRYWALL:

- A. Profile:
1. 2 inches face dimension, 1/2 inch backbend with 5/16 inch return, 5/8 inch high stop, types

and throat dimensions as indicated in drawings.

B. Door Reinforcement and accessories:

1. Hinge preparation for 4-1/2 inches high, full mortise hinges.
2. Strike preparation (single doors) for 4-7/8 inch universal strike; with plaster guard.
3. Projection weld hinge and strike reinforcements to the door frame.
4. Provide metal plaster guards for all mortised cutouts.
5. Include galvanized hardware reinforcements in all galvanized frames.
6. Silencers: Prepare frames to receive inserted type door silencers, 3 per strike jamb on single doors. Stick-on silencers are not permitted.
7. Anchors: Locate adjustable anchors in each jamb 4 inches from the top of the door opening to hold frame in rigid alignment. Provide 14 ga. pressure anchors used in conjunction with base floor clips as required.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.

3.02 PREPARATION

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.
- B. Coat inside of other frames with bituminous coating to a thickness of 1/16 inch.

3.03 INSTALLATION

- A. Install in accordance with the requirements of the specified door grade standard.
- B. Coordinate frame anchor placement with wall construction.
- C. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- D. Coordinate installation of hardware.

3.04 ERECTION TOLERANCES

- A. Clearances Between Door and Frame: As specified in ANSI A250.8.
- B. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.05 ADJUSTING

- A. Adjust for smooth and balanced door movement.

3.06 SCHEDULE

- A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Gypsum wallboard.
- B. Joint treatment and accessories.

1.02 RELATED SECTIONS

- A. Section 07 9005 - Joint Sealers.

1.03 REFERENCES

- A. ASTM C 36, Standard Specification for Gypsum Wallboard.
- B. ASTM C 442, Standard Specification for Gypsum Backing Board, Gypsum Coreboard, and Gypsum Shaftliner Board.
- C. ASTM C 475, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
- D. ASTM C 557, Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
- E. ASTM C 665, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- F. ASTM C 840, Standard Specification for Application and Finishing of Gypsum Board.
- G. 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.
- H. ASTM C 1047, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
- I. ASTM C1396, Standard Specification for Gypsum Board.
- J. Gypsum Association GA-600-2018, Fire Resistance Design Manual.
- K. ASTM D 3273, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- L. Gypsum Association GA 216-2018, Recommended Specifications for the Application and Finishing of Gypsum Board.
- M. Gypsum Association's GA-801, Handling and Storage of Gypsum Panel Products.
- N. ASTM C1629, Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.

1.04 QUALITY ASSURANCE

- A. Perform in accordance with ASTM C 840. Comply with requirements of GA-600 for fire-rated assemblies.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

PART 2 PRODUCTS

2.01 GYPSUM BOARD MATERIALS

- A. Gypsum Wallboard:
 - 1. ASTM C1396.
 - 2. Sizes to minimize joints in place; ends square cut.
 - 3. Thickness: 5/8 inch.
 - 4. Edges: Tapered.
- B. Abuse Resistant Gypsum Wallboard:
 - 1. Basis of Design: USG Sheetrock® Brand Mold Tough® VHI Firecode® X Panels.
 - 2. Thickness: 5/8 inch.
 - 3. UL Type: AR.
 - 4. Sizes to minimize joints in place; ends square cut.
 - 5. Edges: Tapered.
 - 6. Tested to ASTM C1629, Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels, for surface abrasion and indentation resistance, and soft- and hard-body impact

2.02 ACCESSORIES

- A. 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.
- B. Joint Materials: ASTM C 475 and as recommended by gypsum board manufacturer for project conditions.
 - 1. Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
 - 2. Ready-mixed vinyl-based joint compound.
- C. Screws: ASTM C 1002; self-piercing tapping type.
- D. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 STORAGE

- A. Store off the ground and under cover in accordance with Gypsum Association's GA-801, Handling and Storage of Gypsum Panel Products.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Sealant: Install as follows:
 - 1. Clean substrate surface. Place one bead continuously on substrate before installation of perimeter framing members.
 - 2. Place continuous bead at perimeter of each layer of gypsum board.
 - 3. In non-fire-rated construction, seal around all penetrations by conduit, pipe, ducts, and rough-in boxes.

3.04 GYPSUM BOARD INSTALLATION

- A. Comply with ASTM C 840 and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Gypsum Soffit Board: Install perpendicular to framing, with staggered end joints over framing members or other solid backing.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as follows:
 - 1. Not more than 25 feet apart on walls and ceilings over 24 feet long.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 JOINT TREATMENT

- A. Finish gypsum board in scheduled areas in accordance with levels defined in ASTM C 840 and as scheduled below.
- B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
 - 2. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
 - 3. Taping, filling and sanding is not required at base layer of double layer applications.

3.07 TOLERANCES

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

3.08 FINISH LEVEL SCHEDULE

- A. Level 4: Walls, soffits and ceilings exposed to view.
- B. Level 1: Walls not exposed to view.

END OF SECTION

SECTION 09 9000
PAINTING AND COATINGS

PART 1 - GENERAL

1.01 REFERENCE STANDARDS

- A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
- C. All materials, installation and workmanship shall comply with the applicable requirements and standards.

1.02 DEFINITIONS

- A. "Paint" includes coating systems materials, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate, or finish coats.
- B. "Substrate" as used herein means the surface to which paint is to be applied. In the case of previously painted existing surfaces, substrate means the surface to which the existing paint was applied.

1.03 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.
- B. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
- C. Notify the Architect of problems anticipated using the materials specified.
- D. Material Quality: Provide the manufacturer's best quality trade sale paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.
- E. Odor Eliminating Additive: At all locations scheduled to receive solvent or alkyd-based coatings, provide an odor-eliminating additive to minimize the presence of odor from wet and drying paint films.
- F. Provide additive recommended and approved by the primer/finish coat manufacturer for use with their paint.
 - 1. Benjamin Moore does not recommend an "odor eliminator additive" for Benjamin Moore Paints.
 - 2. Subject to compliance with above requirements, "Bio Zapp Paint Odor Eliminator" by Bio Zapp Laboratories, (941/922-9199) is acceptable.

1.04 SUBMITTALS

- A. Samples: Provide samples of each color and material to be applied, with texture to simulate

actual conditions, on representative samples of the actual substrate.

- a. Indicate each separate coat, including block fillers and primers.
- b. Provide a list of material and application for each coat of each sample. Label each sample as to location and application.

B. Product Data:

1. Submit manufacturer's catalog cuts and descriptive information on each product used.
2. Include preparation requirements and application instructions.

C. Record Documents: Provide record of approved samples and product data.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Store materials not in use in tightly covered containers in a well ventilated area at a minimum ambient temperature of 45 deg F (7 degrees C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.
- B. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.
- C. Deliver materials to the job site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
 1. Product name or title of material.
 2. Product description (generic classification or binder type).
 3. Manufacturer's stock number and date of manufacture.
 4. Contents by volume, for pigment and vehicle constituents.
 5. Thinning instructions.
 6. Application instructions.
 7. Color name and number.

1.06 PROJECT CONDITIONS

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 degrees F (10 degrees C) and 90 degrees F (32 degrees C).
- B. Apply solvent thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 degrees F (7 degrees C) and 95 degrees F (35 degrees C).
- C. Do not apply paint in snow, rain, fog, or mist, when the relative humidity exceeds 85 percent, at temperatures less than 5 degrees F (3 degrees C) above the dew point, or to damp or wet surfaces.
- D. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

PART 2 PRODUCTS

2.01 MANUFACTURES

PPG Industries, Inc. www.ppg.com	One PPG Place Pittsburgh, PA 15272
Benjamin Moore Paints www.benjaminmoore.com	101Paragon Drive Montvale, NJ 07645
Glidden Professional www.gliddenprofessional.com	15885 West Sprague Road, Strongsville, OH 44136
The Sherwin-Williams Company www.Sherwin-Williams.com	101 Prospect Ave. Cleveland, OH 44115

2.02 PAINT SCHEDULE

- A. Provide the following paint systems for the various substrates, as indicated. Provide only the listed prime and finish coat materials unless otherwise recommended in writing by the paint manufacturer for each specific substrate.
- B. Where specific finish paint material is not indicated, refer to notes and finish schedules for finish paint material and gloss levels for each surface to be painted.

2.03 INTERIOR PAINTING SCHEDULE

- A. Ferrous Metal; 2 finish coats of water borne semi-gloss acrylic latex enamel over primer:
 3. Waterborne Acrylic Primer:
 - a. PPG: Pitt-Tech 100 percent Acrylic Primer 90-712.
 - b. Benjamin Moore: P29 Super Spec HP Direct to Metal Acrylic Semi-gloss.
 - c. Glidden Professional: Devflex 4020 PF Direct to Metal Primer and Flat Finish.
 - d. S-W: Pro Industrial Pro-Cryl Universal Primer B66 Series.
 4. Finish Coat:
 - a. PPG: Pitt-Tech 100 percent Acrylic Satin Direct to Metal 90-474.
 - b. Benjamin Moore: P29 Super Spec HP Direct to Metal Acrylic Semi-gloss.
 - c. Glidden Professional: Lifemaster Oil Interior/Exterior Semi-Gloss Paint 1506 Series.
 - d. S-W: Pro-Industrial Semi-Gloss Acrylic B66-600 Series.
- B. Galvanized Metal; 2 finish coats of water borne semi-gloss acrylic latex enamel over primer:
 1. Waterborne Acrylic Galvanized Metal Primer:
 - e. PPG: Pitt-Tech 100 percent Acrylic Primer 90-712.
 - f. Benjamin Moore: P29 Super Spec HP Direct to Metal Acrylic Semi-gloss.
 - g. Glidden Professional: Devflex 4020 PF Direct to Metal Primer and Flat Finish.
 - h. S-W: Pro Industrial Pro-Cryl Universal Primer B66 Series.

2. Finish Coat:
 - a. PPG: Pitt-Tech 100 percent Acrylic Satin Direct to Metal 90-474.
 - b. Benjamin Moore: P29 Super Spec HP Direct to Metal Acrylic Semi-gloss.
 - c. Glidden Professional: Lifemaster Oil Interior/Exterior Semi-Gloss Paint 1506 Series.
 - d. S-W: Pro-Industrial Semi-Gloss Acrylic B66-600 Series.
- C. Aluminum: 2 finish coats of water borne acrylic latex enamel over primer:
 1. Waterborne Acrylic Galvanized Metal Primer:
 - i. PPG: Pitt-Tech 100 percent Acrylic Primer 90-712.
 - j. Benjamin Moore: P29 Super Spec HP Direct to Metal Acrylic Semi-gloss.
 - k. Glidden Professional: Devflex 4020 PF Direct to Metal Primer and Flat Finish.
 - l. S-W: Pro Industrial Pro-Cryl Universal Primer B66 Series.
 2. Finish Coat:
 - a. PPG: Pitt-Tech 100 percent Acrylic Satin Direct to Metal 90-474.
 - b. Benjamin Moore: P29 Super Spec HP Direct to Metal Acrylic Semi-gloss.
 - c. Glidden Professional: Lifemaster Oil Interior/Exterior Semi-Gloss Paint 1506 Series.
 - d. S-W: Pro-Industrial Semi-Gloss Acrylic B66-600 Series.
- D. Stained Wood; 2 finish coats over stain:
 1. Stain: Sherwin Williams, Wood Classics Interior Wood Stain.
 2. Finish Coat: Sherwin Williams, Wood Classics Waterborne Polyurethane Varnish.
- E. Gypsum Plaster; 2 finish coats over primer:
 1. Primer:
 - e. PPG: Pure Performance Interior Latex Primer 9-900.
 - f. Benjamin Moore: N372 Eco Spec WB interior latex primer.
 - g. Glidden Professional: LM 9116 Lifemaster 0 VOC Primer.
 - h. S-W: ProMar 200 Zero VOC Interior Latex Primer B28-2600 Series.
 2. Finish Coat:
 - a. PPG: Pure Performance Interior Latex Eggshell 9-300.
 - b. Benjamin Moore: N374 Eco Spec WB Eggshell Finish.
 - c. Glidden Professional: LM 9300 Lifemaster 0 VOC Interior Eggshell.
 - d. S-W: ProMar 200 Zero VOC Interior Latex Eg-shel B20-2600 Series.

PART 3 EXECUTION

3.01 PREPARATION

- F. Examine substrates and conditions under which painting will be performed for compliance with requirements for application of paint. Do not begin paint application until unsatisfactory conditions have been corrected.

- G. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
- H. General Procedures: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items in place that are not to be painted, or provide surface applied protection prior to surface preparation and painting. Remove these items if necessary for complete painting of the items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.
- I. Clean surfaces before applying paint or surface treatments. Remove oil and grease prior to cleaning. Schedule cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- J. Surface Preparation: Clean and prepare surfaces to be painted in accordance with the manufacturer's instructions for each particular substrate condition and as specified.
- K. Provide barrier coats over incompatible primers and existing surfaces, or remove and reprime. Notify Architect in writing of problems anticipated with using the specified finish coat material with substrates primed by others.
- L. Ferrous Metals: Clean non-galvanized ferrous metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council.
- M. Blast steel surfaces clean as recommended by the paint system manufacturer and in accordance with requirements of SSPC specification SSPCSP 10.
- N. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
- O. Touch up bare areas and shop applied prime coats that have been damaged. Wire brush, clean with solvents recommended by the paint manufacturer, and touch up with the same primer as the shop coat.
- P. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum based solvents so that the surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- Q. Materials Preparation: Carefully mix and prepare paint materials in accordance with manufacturer's directions.
- R. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.
- S. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.
- T. Use only thinners approved by the paint manufacturer, and only within recommended limits.

3.02 INSTALLATION

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- B. All installation shall be in accordance with manufacturer's published recommendations

3.03 APPLICATION

- A. Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
- B. Paint exposed surfaces whether or not colors are designated in "schedules," except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available.
- C. Painting of mechanical, electrical, and plumbing items is limited to exposed natural gas piping, exposed fire sprinkler piping, and roof top exhaust fan hoods. Items in mechanical and electrical rooms shall not be field painted unless otherwise scheduled on Drawings.
- D. At "unoccupied" interior areas, painting is not required on prefinished items or finished metal surfaces.
- E. Do not paint over Underwriter's Laboratories, Factory Mutual or other code required labels or equipment name, identification, performance rating, or nomenclature plates.
- F. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
- G. Provide finish coats that are compatible with primers used.
- H. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce an even smooth surface in accordance with the manufacturer's directions.
- I. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
- J. The term "exposed surfaces" includes areas visible when permanent or builtin fixtures, convector covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas as required to maintain the system integrity and provide desired protection.
- K. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment.
- L. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint.
- M. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
- N. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure and where application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
- O. Minimum Coating Thickness: Apply materials at not less than the manufacturer's

recommended spreading rate. Provide a total dry film thickness of the entire system as recommended by the manufacturer.

- P. Prime Coats: Before application of finish coats, apply a prime coat of material as recommended by the manufacturer to material that is required to be painted or finished and has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to assure a finish coat with no burn through or other defects due to insufficient sealing.

3.04 CLEANING

- A. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
- B. Upon completion of painting, clean glass and paint spattered surfaces. Remove spattered paint by washing and scraping, using care not to scratch or damage adjacent finished surfaces.

3.05 PROTECTION

- A. Protect work of other trades, whether to be painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.
- B. Provide "wet paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.
- C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION

SECTION 13 3000
PRE-ENGINEERED STRUCTURES

1. GENERAL

1.1. SECTION INCLUDES

- A. Pre-engineered building and components including the following:
 - 1. Roof covering system including exterior roof panels, panel attachments, sealants, mastics, trim and flashings.
 - 2. Roof Insulation.
- B. Roof accessories including the following:
 - 1. Eave gutters.
 - 2. Roof curbs.

1.2. RELATED SECTIONS

- A. Section 09 9000 - Painting and Coating.

1.3. REFERENCES

- A. American Institute of Steel Construction (AISC):
 - 1. AISC 360 - Specification for Structural Steel Buildings.
 - 2. AISC 341 - Seismic Provisions for Structural Steel Buildings (when appropriate).
 - 3. AISC Design Guide 3 - Serviceability for Steel Buildings
- B. American Iron and Steel Institute (AISI):
 - 1. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members.
- C. American Welding Society (AWS):
 - 1. AWS D1.1 / D1.1M - Structural Welding Code - Steel.
 - 2. AWS D1.3 / D1.3M - Structural Welding Code - Sheet Steel.
- D. Association for Iron & Steel Technology (AISE):
 - 1. AISE 13 - Specifications for Design and Construction of Mill Buildings.
- E. ASTM International (ASTM):
 - 1. ASTM A 325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - 2. ASTM A 653 / A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 3. ASTM A 792 / A 792M - Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - 4. ASTM B 117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.

5. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
6. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.
7. ASTM D 522 - Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
8. ASTM D 523 - Standard Test Method for Specular Gloss.
9. ASTM D 968 - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive.
10. ASTM D 1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
11. ASTM D 2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
12. ASTM D 2247 - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
13. ASTM D 2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
14. ASTM D 3361 - Standard Practice for Unfiltered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
15. ASTM D 4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.
16. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
17. ASTM E 96 / E 96M - Standard Test Methods for Water Vapor Transmission of Materials.
18. ASTM E 1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
19. ASTM G 87 - Standard Practice for Conducting Moist SO₂ Tests.
- F. Metal Building Manufacturers Association (MBMA):
 1. MBMA Metal Building Systems Manual.
 2. Seismic Design Guide for Metal Building Systems.
- G. North American Insulation Manufacturers Association (NAIMA):
 1. NAIMA 202 - Standard For Flexible Fiber Glass Insulation to be Laminated for Use in Metal Buildings.
- H. The Society for Protective Coatings (SSPC):
 1. SSPC-Paint 15 - Primer for Use Over Hand Cleaned Steel performs to SSPC-Paint 15 standards.
 2. SSPC-SP2 - Hand Tool Cleaning.
- I. Underwriters Laboratories (UL):
 1. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies.
 2. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.
- J. US Army Corps of Engineers (COE):

1. COE Unified Facilities Guide Specification Section 07 61 13.

1.4. SYSTEM DESCRIPTION

A. General:

1. Provide metal roof panels, accessories and miscellaneous materials for a complete enclosure including supports for building components specified in other sections.
2. SSR Roof System tested and certified to meet Underwriters Laboratories UL 90 wind uplift rating.
3. Panel fastening meeting uplift requirements based on tested fastener values with appropriate Safety Factors.

B. Performance Requirements:

1. Construct assembly to permit movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to temperature range of 100 degrees F (37 degrees C) in a 24 hour period.
2. Design and fabricate wall and roof systems free of distortion or defects detrimental to appearance or performance. Some oil canning in rolled panels especially in the flats of the panel is normal and is not cause for rejection.

1.5. SUBMITTALS

- A. Submit under provisions of Section 01 3000 - Administrative Requirements.
- B. Shop Drawings: Show building layout, primary and secondary framing member sizes and locations, cross-sections, and product and connection details.
- C. Product Data: Information on manufactured products to be incorporated into the project.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

1.6. QUALITY ASSURANCE

- A. Installer Qualifications - Firm experienced in application or installation of systems similar in complexity to those required for this project, plus the following:
 1. Acceptable to or licensed by manufacturer.

1.7. 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.

1.8. 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 recommended limits..

2. PRODUCTS

2.1. MANUFACTURERS

- A. Acceptable Manufacturer: Varco Pruden Buildings, which is located at: 3200 Players Club Circle; Memphis, TN 38125; Toll Free Tel: 866-538-0012; Tel: 901-748-8000; Fax: 901-748-9323; Email: request info (vpsales@vp.com); Web: www.vp.com

2.2. ROOF COVERING SYSTEM

- A. Roof Panels: "SSR" Standing Seam Roof Panels; 24 inches wide net coverage, with 3 inches high major ribs formed at the panel side laps, formed for field seaming using electrically operated seaming machine.
 - 1. Side joints: Factory applied sealant.
 - 2. Material (Unpainted): Acrylic coated AZ55 Galvalume steel unpainted.
 - 3. Thickness: 24 gage.
 - 4. Side laps: Two factory-formed interlocking ribs, with one weather sealed joint, field-seamed into place to form a double-fold 360 degree seam.
 - 5. Length: Continuous from eave to ridge up to 55 feet in length.
 - 6. End laps, where required: 4 inches wide, located at a support member.
 - 7. Panel-to-roof purlin structural attachments: SSR clips with movable tabs which interlock with seamed SSR panel ribs and provide for 1-5/8 inches of panel movement in either direction from center of clip to compensate for thermal effects.
 - 8. SSR Ridge; draw-formed aluminum seam caps factory-attached to SSR ridge panels that are seamed together along the center of the ridge, utilizing only one weather sealed joint and providing a true expansion joint for panel movement.
 - 9. Rake edge of roof shall be attached to the building structure in a manner which will allow thermal expansion of the SSR roof panels along the gables and will provide the uplift resistance required by code.
 - 10. SSR roof will meet the requirements for UL Class 90 wind uplift.
 - 11. Exposed fasteners are stainless steel capped painted to match roof color.

2.3. INSULATION

- A. Laminated Fiberglass: Owens-Corning Fiberglas, NAIMA 202, "Certified R" metal building insulation.
 - 1. TIMA Insignia and Insulation Thickness: Ink-jet printed on fiberglass.
- B. Roof Insulation:
 - 1. Certified R-Value: 25.
- C. Roof Insulation Facing: WMP-50.
 - 1. 0.0015-inch-thick, UV-stabilized, white polypropylene film laminated to 30-pound Kraft paper/metalized polyester, reinforced with glass-fiber and polyester scrim.
 - 2. Adhere facing to Owens-Corning Fiberglas "Certified R", NAIMA 202, fiberglass blanket.
 - 3. Assembly of Insulation Blanket and Facing:
 - a. Flame Spread Rating: Less than 25.

- b. UL Label: Submit as specified in Submittals article of this section.
- c. Perm Rating: 0.02.

2.4. ROOF ACCESSORIES

- A. Eave Gutters: Roll-formed 26 gage steel sheet, with gutter straps, fasteners and joint sealant; manufacturer's standard color.
- B. Multi-Gutters and Valley Gutters: 0.059 inch (17 gage) thick cold-formed steel sheet.
 - 1. Finish: G90/Z275 galvanized coated.
 - 2. VP provides gutter wedges only. Gutter liner and all outlet material for water drainage is typically by others.
- C. Roof Curbs: Welded units fabricated for shingled installation with roof panels; minimum 18 gage Galvalume coated steel, with welds cleaned and treated with protective coating compatible with the Galvalume substrate.
 - 1. Top of curbs horizontal with 1-1/2 inch perimeter flange.
 - 2. Curb walls insulated with 1-1/2 inch, 3 pcf density rigid glass fiber insulation.
 - 3. Water diversion: Integral 4 inch high by full length cricket on upslope side.
 - 4. Exposed curb flanges pre-drilled for correct fastener locations.
 - 5. Upslope and down slope curb flanges with integral welded inside and outside cell closures compatible with the roof panel profile.
 - 6. Curb framing: Mounted on secondary structural members and installed from the top; compatible with the thermal expansion and contraction properties of the roof on which it is used.
 - 7. Opening size: As indicated on drawings.

2.5. MATERIALS

- A. Galvanized Steel Sheet for Roll Formed or Press Broken Roof and Wall Coverings, Trim and Flashing: ASTM A 653/A 653M, with minimum yield strength of 50,000 psi (345 MPa).
- B. Galvalume Steel Sheet Used in Roll Formed or Press Broken Roof Covering: Aluminum-zinc alloy-coated steel sheet, ASTM A 792/A 792M, with minimum yield strength of 50,000 psi (345 MPa); nominal coating weight of 0.5 oz per sq ft both sides, equivalent to an approximate coating thickness of 0.0018 inch both sides.
- C. Panel Fasteners:
 - 1. For Galvalume finished roof: Stainless Steel-capped carbon steel fasteners with integral sealing washer.
 - 2. Color of exposed fastener heads to match the roof panel finish.
 - 3. Concealed Fasteners: Self-drilling type, of size as required.
 - 4. Provide fasteners in quantities and location as required by the manufacturer.
- D. Flashing and Trim: Match material, finish, and color of adjacent components. Provide trim at rakes, including peak and corner assemblies, high and low eaves, corners, bases, framed openings and as required or specified to provide weather tightness and a finished appearance.

- E. Sealants, Mastics and Closures: Manufacturer's standard type.
 - 1. Provide at roof panel end laps, side laps, rake, eave, transitions and accessories as required to provide a weather resistant roof system; use tape mastic or gun grade sealant at side laps and end laps.
 - 2. Provide at wall panel rakes, eaves, transitions and accessories.
 - 3. Closures: Formed to match panel profiles; closed cell elastic material, manufacturer's standard color.
 - 4. Tape mastic: Pre-formed butyl rubber-based, non-hardening, non-corrosive to metal; white or light gray.
 - 5. Gun grade sealant: Non-skinning synthetic Elastomeric based material; gray or bronze.

2.6. FINISH

- A. Schedule of Finishes:
 - 1. Finishes of components shall match existing.

3. EXECUTION

3.1. EXAMINATION

- A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper and or timely completion.
 - 1. Verify foundations are properly installed, to correct dimensions and within acceptable tolerances.
 - 2. Verify location of covered or built-in work.
 - 3. Do not proceed until unsatisfactory conditions have been corrected.

3.2. PREPARATION

- A. Framing Erection: Erect framing in compliance with AIS Specification and the latest edition of the MBMA metal building systems manual.
- B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing. Locate braced bays as required by manufacturer.

3.3. INSTALLATION

- A. Install in compliance with manufacturer's instructions and approved submittals.
 - 1. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.
 - 2. Fasten cladding system to structural supports, aligned level and plumb.
 - 3. Locate end laps over supports. End lap panels according to manufacturer's recommendations. Place side laps over adjacent panel and mechanically seam or stitch fastener per erection guidelines.

4. Provide expansion joints where indicated.
 5. Use concealed fasteners.
 6. Install sealant and gaskets to prevent weather penetration.
 7. Install system free of rattles, noise due to thermal movement, and wind whistles.
 8. Install gutter system in compliance with manufacturer's instructions.
 9. Seal roof accessories watertight and weather tight with sealant in compliance with building manufacturer's standard procedures.
 10. Rigidly support and secure gutters and downspouts. Joint lengths with formed seams sealed watertight. Flash and seal gutters to downspouts.
- B. Tolerances:
1. Framing Members: 1/4 inch from level; 1/8 inch from plumb.

END OF SECTION

SECTION 13 9901
MISCELLANEOUS WORK

PART I - GENERAL

1.01 SECTION INCLUDES

- A. Placement of base ice
- B. Placement of Ice markings
- C. Installation of kickplate
- D. Installation of floor drain
- E. Installation of anchors in concrete floor

1.02 DESCRIPTION OF WORK

- A. Base ice placement includes placement of initial layer of "black ice", plus placement of additional ice layers in conjunction with placement of ice markings to a total base ice depth of 0.25-inch.
- B. Ice marking placement includes the following, in conjunction with base ice placement:
- C. White background by contractor.
- D. Mid-lines, neutral zone lines, face-off circles, base lines and goal creases by contractor.
- E. Logos will be placed by Arena staff concurrent with base ice placement and ice marking placement by contractor.
- F. Installation of kickplate around ice rink perimeter prior to placement of base ice. Installation of floor drain per plans.
- G. Installation of anchors for hockey goal nets and other anchors per plan.

1.03 SUBMITTALS

- A. Product catalog excerpts for ice marking products.
- B. Product catalog excerpt for kickplate.
- C. Product catalog excerpt for floor drain casting, pipe and associated fittings.
- D. Product catalog excerpts for Marsh pegs and eyebolt anchors.

1.04 SCHEDULE AND CONFLICTS

- A. Coordinate base ice placement and ice marking placement with Ice Arena staff to facilitate work to be performed by Arena staff.
- B. Coordinate installation of floor drains and associated piping and work with Arena staff to minimize disruption of normal arena operations.
- C. Anchors
- D. Install Marsh pegs for hockey goal nets at locations per plans.
- E. Install eyebolt anchors at locations determined by Arena staff (up to 12 anchors).

PART 2— MATERIALS

2.01 BASE ICE

- A. Water for base ice placement shall be City water furnished by the owner at no expense to the contractor.

2.02 ICE MARKINGS

- A. Ice Paint
 - 1. White background, all lines, face-off circles and goal creases shall be painted using Jet Ice paints only.
 - 2. Use of other paint products or paper or vinyl line kits is not allowed
- B. Logos in ice shall be furnished and placed by Ice Arena staff.

2.03 KICKPLATE

- A. Dimensions: 1A-inch thick by 8-inch wide
- B. Material: high density polyethylene
- C. Color: federal yellow or similar color approved by Arena staff

2.04 FLOOR DRAIN INSTALLATION

- A. Floor Drain Casting
 - 1. Material: gray iron conforming to ASTM A48, Class 35
 - 2. Nominal Dimensions: 3-feet long by 1-foot wide
 - 3. Heavy duty casting suitable for vehicle traffic areas. Provide grated cover.
 - 4. Bottom outlet, closed ends.
 - 5. Neenah R-4996-A1 or equal.
- B. Pipe
 - 1. Cast iron soil pipe (CISP) conforming to AWWA C106.
 - 2. Fittings conforming to AWWA C10.

2.05 ANCHORS

- A. Marsh pegs suitable for hockey goal nets.
- B. Eyebolt anchors, galvanized, 3/4-inch size.

PART 3 - EXECUTION

3.01 BASE ICE PLACEMENT

A. Preparation

1. Remove all dust, dirt, oils and other materials that may prevent ice adhesion by suitable methods.
2. Using newly installed piping system, cool concrete floor to nominally 20-degrees Fahrenheit or other suitable temperature for ice formation.

B. Sequence (including placement of ice markings)

1. Initial ice placement using repeated fine water sprays to 1/8-inch depth.
2. Place white background paint and Fittings
3. Place minimum six (6) fine water sprays over painted white background to nominal 1/16-inch depth to seal.
4. Place painted lines, circles and other ice markings per plans.
5. Logos shall be placed by Arena staff.
6. Place minimum six (6) fine water sprays over painted markings to nominal 1/16-inch depth to seal.
7. Net depth of base ice placement by contractor: 1A-inch.
8. Remaining ice to 1-inch total depth shall be placed by Arena staff.

C. Quality Control

1. Arena staff will verify initial ice placement has good adhesion to concrete floor.
2. All care, including use of fine sprays, shall be taken to ensure base ice has no entrapped air bubbles.
3. Newly placed ice shall have a clean uniform appearance.
4. Arena staff shall approve base ice placement.

3.02 PLACEMENT OF ICE MARKINGS

- A. Place painted markings in conjunction with base ice placement as described in Paragraph 3.01B above.
- B. Place painted ice markings in accordance with manufacturer's recommendations. Arena staff shall approve ice marking placement.

3.03 KICKPLATE INSTALLATION

A. Preparation

1. Expansion joint between perimeter concrete and new concrete ice rink floor must be in place.
2. Dasherboards must be reinstalled.
3. Clean face of dasherboards and concrete ice rink floor where they will be in contact with

kickplate.

B. Installation

1. Anchor kickplate to dasherboard with anchor bolts or suitable adhesives furnished by manufacturer.
2. Place kickplate to ensure consistent contact with concrete ice rink floor and top of kickplate is straight and uniform along face of dasherboards.

3.05 ANCHORS

A. Marsh Pegs for Hockey Goal Nets

1. Install per manufacturers recommendations, including whether pegs are flush with or above finished concrete surface.

B. Eyebolt Anchors

1. Anchor shaft shall be embedded in concrete. Eyebolt portion shall be above concrete, embedded in finished ice.

SECTION 20000

UNDER-FLOOR & IN-FLOOR PIPING SYSTEMS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Installation of under-floor piping system (subgrade heating).
- B. Installation of in-floor piping system (refrigerant piping embedded in concrete floor).
- C. Installation of header pipes.

1.02 DESCRIPTION OF WORK

- A. Installation of under-floor piping system includes furnishing and installing pipe and associated fittings, and appurtenances required for under floor heating system.
- B. Installation of in-floor piping system includes furnishing and installing pipe and associated fittings, spacers and appurtenances required for in-floor refrigerant piping system. Said system shall be imbedded in concrete floor.
- C. Installation of header pipes includes furnishing and installing header pipes, anchors and related appurtenances, plus excavation required to embed header pipes below granular subbase and connect to existing header pipes where indicated on plans.

1.03 SUBMITTALS

- A. Product catalog excerpts for pipe and fittings.
- B. Product catalog excerpts for pipe spacers and chairs.

1.04 TESTING

- A. Refer to Section 01110 and Special Provisions for testing requirements.

PART 2 – PRODUCTS

2.01 PIPE AND FITTINGS

- A. Polyethylene Pipe (HPPE)
 - 1. ASTM D3350 applies.

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2. All pipes, including headers, shall be SDR-11.
3. 160 PSI pressure rating.
4. Comply with requirements for Type 14, Class C, Category 5, Grade P34 according to ASTM D1248.
5. Joints and connections shall be fusion welded.

B. Fittings

1. All fittings shall be socket type conforming to ASTM D2683.
2. Inside diameter of fittings same as inside pipe diameter.
3. Fittings shall be manufactured, not field or shop fabricated.

2.02 SPACERS AND PIPE SUPPORTS

A. In-Floor System

1. Manufactured wire spacers designed to maintain required spacing and position in floor.
2. Spacer assemblies shall be provided in 6-foot nominal lengths.
3. Approved products: Type 'U' spacers manufactured by Hunter Wire Products Ltd., 60 Heaton Avenue, Winnipeg, MB, Canada.
4. Field fabricated or shop fabricated spacers are not permitted.

B. Shims for adjusting pipe elevations shall be plastic or steel.

C. Anchors for in-floor system headers

1. Uni-Strut, 1-5/8 inch anchors
2. Grinnel PS-1200 or equal clamps.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

- A. All under floor heating and in-floor piping shall be continuous. There shall be no joints, splices or additional fittings other than indicated on the drawings. Headers and piping shall be supplied in typical lengths.
- B. All piping and fittings shall be connected by fusion welding. Contractor shall perform and demonstrate in the field for the Engineer prior to placement of polyethylene pipe. Submit two (2) samples of a typical fusion welded joint from the demonstration.
- C. Contractor shall inspect the interior and exterior of all butt and socket joints wherever possible to assure there are no blockages and that joints are formed to manufacturer's specifications.
- D. Thoroughly flush all piping systems before installation of secondary refrigerant. The Engineer shall be notified to observe final flushing procedures.

- E. Secondary refrigerant is to be provided under separate contract. Coordinate system fill with mechanical contractor for ice arena infrastructure upgrade project.

3.02 GRANULAR SUBBASE PREPARATION

- A. The placement and preparation of granular subbase shall not commence until the subgrade preparation operation, and any special subgrade treatment and/or subgrade stabilization has been completed.
- B. The placement of granular subbase, compacted to specifications herein, shall be performed following trenching operations.
- C. Upon placement of the granular subbase, the material shall have a moisture content in a range between the optimum moisture content and minus 2 percent of the optimum moisture content. The material will then be placed at the proper elevation and cross section such that, when compacted it will be at the correct elevation.
- D. Granular subbase shall be extended to a minimum of 2 feet beyond the back of curb line.
- E. Where storm sewer or subdrain has been installed parallel to the back of curb line, the Contractor shall take care to provide that clean porous trench backfill is in contact with clean granular subbase material. Any silt, mud, or foreign material which might serve to contaminate the porous trench backfill shall be removed before placing the granular subbase.
- F. The material shall be worked at the proper moisture content to provide for a minimum 95 percent compaction (ASTM D698).
- G. The Contractor is responsible for the maintenance of the completed subbase. If rutting or any other damage occurs to the subgrade for any reason, the Contractor shall immediately repair the subbase as set forth in this section.
- H. Unless noted otherwise in the Contract Documents, construction traffic is permitted on placed granular subbase, but it shall be kept to a practical minimum. The Contractor shall clean, replace contaminated material, or otherwise restore the granular subbase to a free-draining condition prior to pavement placement.
- I. The profile and cross section tolerances for granular subbase shall be zero to —0.05 feet.

3.03 UNDER-FLOOR PIPING SYSTEM

- A. Preliminary
 - 1. Complete removal and any required re-grading and re-compacting of insitu native soil base.
 - 2. Excavate trench for in-floor piping system headers and pipes per plans.

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B. Installation of Pipes and Fittings

1. Lay under-floor heating system pipes and headers on insitu native soil base per plans.
2. If applicable, excavate as required at pipe joints so pipe barrels are bearing uniformly on soil base along entire length.
3. Solvent weld joints per manufacturer's recommendations.
4. Connect system pipes to header pipes.
5. Connect header pipes to existing supply and return pipes at rink perimeter.

C. Perform testing per Section 01110 and Special Provisions.

D. After initial testing is completed, place and compact granular subbase material.

3.04 IN-FLOOR PIPING SYSTEM

A. Preliminary

1. Complete installation and testing of under-floor piping system and placement of granular subbase per plans.
2. No changes to in-floor system pipe alignment or elevations shall be made unless approved by Engineer.
3. All pipe and fittings shall be inspected for defects and damage prior to installation.
4. All piping shall be supported to prevent vibration or horizontal or vertical movement.
5. Complete installation of rigid insulation boards and vapor barrier per plans, including in-floor system header pipe trench.
6. Install header pipes for in-floor piping system.
 - a. Connect header pipes to existing supply and return pipes at rink perimeter.
 - b. Install anchoring system for header pipes per plans, including in-floor system header pipe trench.
 - c. Install fittings for connecting header pipes to in-floor system pipes per detail in plans.

B. Installation of Pipes and Fittings

1. Coordinate pipe installation with placement of steel reinforcement.
2. Place pipe spacer assemblies per plans.
3. Place in-floor pipes in spacers per plans and manufacturer's recommendations.
4. Tie in-floor pipes to pipe spacer assemblies with nylon ties. At minimum, tie at least half of pip/rebar crossings.
5. Install steel chill ring around floor perimeter per plans and tie to steel reinforcement and in-floor piping with wire ties.
6. Before placing welded wire mesh on top of in-floor piping system, verify clearances of pipe and reinforcement to finished concrete.
7. In-floor piping shall be installed within 1/8-inch plus or minus of elevation shown on plans. Use plastic or steel shims to adjust pipe elevations as required.

C. Perform testing for Section 01110 and Special Provisions.

D. After initial testing complete, install welded wire mesh and tie to in-floor piping with wire ties.

E. Pour continuous concrete slab floor to proper elevation and finish as indicated on plans.

3.05 BASE ICE REPLACEMENT

- A. Water for base ice placement shall be City water furnished by the owner at no expense to the contractor.
- B. Preparation
 - 1. Remove all dust, dirt, oils and other materials that may prevent ice adhesion by suitable methods.
 - 2. Using newly installed piping system, cool concrete floor to nominally 20-degrees Fahrenheit or other suitable temperature for ice formation.
- C. Sequence (including placement of ice markings)
 - 1. Initial ice placement using repeated fine water sprays to 1/8-inch or less in depth.
 - 2. Place background paint.
 - 3. Continue with successive water sprays to owner specified ice slab thickness.

END OF SECTION 20000

SECTION 230529

HANGERS AND SUPPORTS FOR HVAC DUCTS AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze hangers.
 - 3. Fastener systems.

1.02 ACTION SUBMITTALS

- A. Existing pipe hangers are to be reused wherever possible. Furnish new pipe hangers as required.
- B. Product Data: For each type of product.

1.03 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.04 QUALITY ASSURANCE

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Hangers and supports for HVAC ducts and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

2.02 TRAPEZE HANGERS

- A. Description: MSS SP-58, Type 59, shop- or field-fabricated assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 BAND HANGERS

- A. Steel bands for suspended ductwork constructed as specified in Chapter 5, SMACNA HVAC Duct Construction Standards, 3rd Edition, 2006.

2.04 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

- 1. Approved Manufacturers:

- a. Hilti
 - b. ITW Ramset / Redhead
 - c. MKT Fastening
 - d. Simpson Strong Tie
 - e. Approved Equivalent

- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

- 1. Approved Manufacturers:

- a. B-Line
 - b. Hilti
 - c. ITW Ramset / Redhead
 - d. MKT Fastening
 - e. Approved Equivalent

2.05 MATERIALS

- A. Aluminum: ASTM B221.
- B. Carbon Steel: ASTM A1011.
- C. Structural Steel: ASTM A36, carbon-steel plates, shapes, and bars; black and galvanized.
- D. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

- A. Metal Duct-Hanger Installation: Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze or Band Hanger Installation: Comply with SMACNA Duct Construction Standards as outlined in tables 5-1, 5-5 and figure 5-5. Arrange for grouping of parallel runs of horizontal ducts, and support together on field-fabricated trapeze pipe hangers.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of ducts, and support together on field-assembled strut systems.
- D. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Install hangers complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Install hangers to allow controlled thermal and seismic movement of HVAC systems, to permit freedom of movement between duct anchor points, and to facilitate reasonable flexibility at HVAC equipment.
- G. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

3.02 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze and band hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.03 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.04 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

3.05 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying HVAC systems and equipment.
- B. Comply with SMACNA HVAC Duct Construction Standards, 3rd Edition for hanger selections and applications that are not specified in plans.
- C. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- D. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- E. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts Friction Clamp, Beam Clamp, Welded Stud: For upper attachment to suspend pipe hangers from ceiling.
- F. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 233300
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Manual volume dampers.
 - 2. Smoke dampers.
 - 3. Flexible connectors.
 - 4. Duct accessory hardware.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Exposed-Surface Finish: Mill phosphatized.

2.3 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
 - 1. Standard leakage rating.
 - 2. Suitable for horizontal or vertical applications.
 - 3. Frames:
 - a. Frame: Hat-shaped, 0.094-inch- thick, galvanized sheet steel.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - 4. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized-steel, 0.064 inch thick.
 - 5. Blade Axles: Galvanized steel.
 - 6. Bearings:
 - a. Oil-impregnated bronze or Molded.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - 7. Tie Bars and Brackets: Galvanized steel.

2.4 SMOKE DAMPERS

- A. General Requirements: Label according to UL 555S by an NRTL.
- B. Smoke Detector: Integral, factory wired for single-point connection.
- C. Frame: Hat-shaped, galvanized sheet steel, with welded corners and mounting flange; gauge in accordance with UL listing.
- D. Blades: Roll-formed, horizontal, overlapping, galvanized sheet steel; gauge in accordance with UL listing.
- E. Leakage: Class I.
- F. Rated pressure and velocity to exceed design airflow conditions.
- G. Mounting Sleeve: Factory-installed, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone caulking; gauge in accordance with UL listing.
- H. Damper Motors: two-position action.

- I. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors.
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections as required to interface with building management system.
 - 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 - 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism. Enclose entire spring mechanism in a removable housing designed for service or adjustments.
 - 5. Electrical Connection: 115 V, single phase, 60 Hz.
- J. Accessories:
 - 1. Auxiliary switches for signaling, fan control, or position indication.
 - 2. Test and reset switches, remote mounted.

2.5 DUCT-MOUNTED ACCESS DOORS

- A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
 - 1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
 - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 - 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.

2.6 FLEXIBLE CONNECTORS

- A. Materials: Flame-retardant or noncombustible fabrics.
- B. Coatings and Adhesives: Comply with UL 181, Class 1.
- C. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd.
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.

3. Service Temperature: Minus 40 to plus 200 deg F.
- D. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 1. Minimum Weight: 24 oz./sq. yd.
 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
 3. Service Temperature: Minus 50 to plus 250 deg F.

2.7 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel, and aluminum accessories in aluminum ducts.
- C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 1. Install steel volume dampers in steel ducts.
 2. Install aluminum volume dampers in aluminum ducts.
- D. Set dampers to fully open position before testing, adjusting, and balancing.
- E. Install test holes at fan inlets and outlets and elsewhere as indicated.
- F. Install and smoke dampers according to UL listing.
- G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 1. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 2. At each change in direction and at maximum 50-foot spacing.
 3. Control devices requiring inspection.

- 4. Elsewhere as indicated.
- H. Install access doors with swing against duct static pressure.
- I. Access Door Sizes:
 - 1. One-Hand or Inspection Access: 8 by 5 inches.
 - 2. Two-Hand Access: 12 by 6 inches.
 - 3. Head and Hand Access: 18 by 10 inches.
- J. Install flexible connectors to connect ducts to equipment.
- K. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Operate dampers to verify full range of movement.
 - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 - 3. Operate smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
 - 4. Inspect turning vanes for proper and secure installation.

END OF SECTION 233300

SECTION 233713.23
REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fixed face grilles.

B. Related Requirements:

1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Register and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 GRILLES

A. Fixed Face Grille (S-1):

1. Material: Aluminum.
2. Finish: Baked enamel, white.
3. Face Blade Arrangement: Horizontal; spaced 3/4 inch apart.
4. Face Arrangement: Horizontal blades.
5. Core Construction: Integral.
6. Frame: 1 inch wide.
7. Mounting: Countersunk screw.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where grilles are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install registers and grilles level and plumb.
- B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install grilles with airtight connections to ducts and to allow service and maintenance of dampers.

3.3 ADJUSTING

- A. After installation, adjust grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.23

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SECTION 26 05 00 COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 WORK INCLUDES

- A. All labor, materials, equipment, tools and services required to perform all work and services for execution, installation and completion of all electrical work including all parts lists, operating instructions, wiring and control diagrams as shown on the drawings and as specified and completely coordinated with work of all other trades.
- B. All supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete electrical installation, although such work is not specifically indicated.
- C. Complete, in operative condition and to approval of Engineer, materials contemplated herein and shown on drawings.
- D. Equipment, materials and accessories for electrical systems as shown and noted on the drawings including but not limited to the following:
 - 1. A complete rough-in system including conduit, outlet boxes, pull boxes, junction boxes, sleeves and hangers.
 - 2. Complete wiring system.
 - 3. All cutting and patching.
 - 4. Wiring devices and coverplates.
 - a. Interconnecting power raceway and wiring for specified heating and refrigeration equipment, unless otherwise shown.
 - b. Interconnecting power raceway and wiring for specified ventilating equipment, unless otherwise shown.
 - c. Starters, controllers and interconnecting power and control raceway and wiring for specified pumps unless otherwise shown.
 - d. Flashing and sealing of all raceway roof penetration.

1.02 DELIVERY, STORAGE AND HANDLING

- A. Manufacturer to prevent damage during shipment shall suitably package materials. Damaged materials will not be acceptable for use.
- B. Store materials on site in clean, dry storage area; when outside, elevated above grade and enclosed with durable watertight wrapping.
- C. Handle all materials carefully to prevent damage. Minor scratches, marks or blemishes to finish shall be repaired to satisfaction of Engineer.

1.03 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Permits: Arrange and pay for all permits, inspections and utility connections required.
 - 2. Comply with ANSI C1, National Electrical Code, 2011.
 - 3. Reference Publications:
 - a. American National Standards Institute, ANSI.
 - 1) C80.1 - Specification for Rigid Steel Conduit, zinc coated.
 - 2) C80.3 - Specification for Electrical Metallic Tubing, zinc coated.
 - 3) C80.4 - Specification for fittings for Rigid Metal Conduit and EMT.
 - b. National Electrical Manufacturers Association, NEMA.
 - 1) OS-1 - Sheet steel outlet boxes, device boxes, covers and box supports.
 - 2) 250 Enclosures for electrical equipment.
 - 3) WC-5 - Thermoplastic insulated wire and cable.
 - 4) WD-1, WD-5 - General Purpose Wiring Devices.
 - 5) FB-1 - Conduit and cable assemblies.
 - 6) KS-1 - Switches.

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- c. Manufacturer's Catalog.
 - 1) Catalogs of specified manufactures current at date of contract documents are incorporated by reference to same force and effect as if repeated herein. In conflicts between catalogs and project manual. Project Manual governs.
- 4. Provide all new materials, without blemish or defect, in accord with standards specified and NRTL (Nationally Recognized Testing Laboratory) listed or labeled.

1.04 STANDARDS

- A. Provide materials, perform work and install materials in strict accordance with the latest requirements of the following:
 - 1. National Electrical Code (NEC) of National Fire Protection Association (NFPA).
 - 2. Other applicable codes and standards of NFPA.
 - 3. Factory Mutual System (FM).
 - 4. American National Standards Institute (ANSI).
 - 5. Occupational Safety and Health Act (OSHA).
 - 6. Federal, state and local codes, laws, ordinances; and rules and regulations of authorities having jurisdiction.
 - 7. In case of conflict or disagreement between codes, laws, ordinances, rules and regulations or within either document itself, the more stringent condition shall govern.
 - 8. Use electrical materials tested, listed and labeled by NRTL and bearing the NRTL label.
 - a. All fabricated assemblies, manufactured items or electrically operated equipment shall have NRTL approval or NRTL re-examination listing in every case where such approval has been established for the particular type of materials or devices in question.

1.05 DEFINITIONS

- A. Wherever the words "the Contractor", "this Contractor" or "Electrical Contractor", appear in this section, they refer to the Contractor for Electrical Work.
- B. The term "provide" includes such labor, methods, materials, equipment and transportation or other facilities required to complete the Contract, and the performance of all duties thereby upon the Contractor.

1.06 GUARANTEE

- A. In entering into a contract covering this work, the contractor accepts the specifications and guarantees that the work will be carried out in accordance with the requirements of this specification or such modifications as may be made under the contract documents.
- B. Contractor further guarantees that the workmanship and material will be of the best procurable and that none but experienced workmen familiar with each particular class of work will be employed.
- C. Contractor further guarantees to replace and make good at his own expense all defects, which may develop within 1 year after final payment and acceptance by the Engineer, due to faulty workmanship or material, upon, receipt of written notification from the Owner.

1.07 JOB CONDITIONS

- A. Existing conditions:
 - 1. In order to become familiar with the scope of the work involved, visit the existing site, before submitting bid, and carefully examine the existing condition in order to have full knowledge and understanding of the conditions and restrictions affecting the performance of the work required. Include in bid all work which is reasonably inferred by the contract drawings and specifications, whether specifically shown or not, as a result of existing conditions, construction, irregularities and interferences which may affect work. No additional compensation will be considered for misunderstanding the conditions to be met.
 - 2. The layout shown on the drawings is necessarily diagrammatic but shall be followed as closely as other work will permit. Changes from these drawings required to make this work conform to the building construction shall be made only with prior written approval of the Engineer. All proposed changes shall be shown on shop drawings. All measurements shall be verified by actual observation and all work shall fit in place meeting the approval of the Engineer.
 - 3. The contractor shall provide openings required in new and existing construction that may be necessary for the installation of electrical work and all patching and workmen competent in the trade required, at the expense of the contractor shall do repairing. The contractor shall be responsible for arranging the work

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so that minimum cutting will be required. All rubbish and excess materials involved in such cutting shall be promptly removed from the site and disposed of by the contractor. Cutting through the floor or roof systems or load bearing walls shall be done only with the prior written approval of Engineer so as to avoid damaging the structural system.

4. Sequencing, scheduling:
 - a. Confer with the contractor regarding the location and size of conduits, equipment, rough-in openings and special architectural treatments in order that there may be no interferences between the installation or the progress of the work of the contractor on the project. The order of space preference shall be as listed above.
 - b. In the case of interconnection of the work of two or more contractors, verify at the site or on shop drawings all dimensions relating to such work. All errors due to the failure to so verify any such dimensions shall be promptly rectified.
 - c. All line voltage wiring and final connections to complete mechanical systems shall be provided by the Electrical Contractor. All electrical conduit, wire, and connections relating to mechanical equipment controls and all wiring associated with starter holding coils, shall be the responsibility of the contractor installing the mechanical equipment unless otherwise indicated on the drawings. The contractor installing the mechanical equipment shall be responsible for magnetic motor starters where such starters are part of the control package of the equipment supplied. All other starters shall be furnished and installed by the Electrical Contractor.
 - d. Access panels, in walls or ceilings, required for access and maintenance shall be provided by the respective contractor. Access panels are not required in areas where the ceiling system is lay-in tile; however, sufficient space must be available in and through the ceiling system to allow maintenance and adjustment of equipment. Access panels shall be approximately 15 inches by 18 inches wherever possible and shall be provided with flush trim and an allen key operated cam lock fastener. Karp, Milcor, or Bilco shall manufacture panels.
 - e. Items of equipment may be specified in the singular however, provide and install the number of items of equipment as indicated on the drawings and as required for a complete system.
 - f. Each contractor shall provide excavating, pumping, backfilling, and compacting required for the installation of their respective work as shown on the drawings.
 - g. Equipment and devices furnished and installed by electrical contractors, which have factory prime coat, or final surface finish shall be replaced, repaired or refinished if defective or damaged during installation.
 - h. Arrange all work so a minimum period of interruption or outages will occur in the temporary or permanent transfer of services as required for all electrical revisions. Not less than 10 Day notification to the Owner shall be required before approval will be granted for any disruption of gas, electric, or telephone services. The outage request shall include the extent of the work to be done, length of outage time required, and the time at which the outage is to begin.
 - i. Submit a "Sequence of Work Schedule" in respect to all temporary and permanent utility and service cutovers after final determination. This schedule shall be submitted for approval to the Engineer. The submittal shall designate priority order, service or utility affected, date of cutover, and time of day to start and finish.

PART 2 - PRODUCTS

2.01 RACEWAYS AND CONDUIT

- A. Electrical Metallic Tubing (thin wall conduit, EMT)
 1. All electrical metallic tubing shall be hot dipped galvanized coated, bear a NRTL label and shall conform to Federal Specifications WW-C-563, ANSI C80-3, and UL 797.
 2. Allied Tube and Conduit Corp., Republic Steel Corp., Wheatland Tube Co., Southwire Co. shall manufacture all electrical metallic tubing, or Engineer approved equal.
- B. Rigid Steel Conduit
 1. All rigid steel conduits shall be hot dipped galvanized coated plus a secondary coat with galvanized threads bears a NRTL label and shall conform to Federal Specifications WW-C-581d, ANSI C80-1.
 2. Allied Tube and Conduit Corp., Republic Steel Corp., Wheatland Tube Co., Southwire Co. shall manufacture all rigid steel conduits, or Engineer approved equal.
- C. Intermediate Metal Conduit (IMC)
 1. Intermediate metal conduit shall be hot dipped galvanized coated; galvanized coated threads bear a NRTL label and shall conform to a NRTL standard for IMC.
 2. Allied Tube and Conduit Corp., Republic Steel Corp., Wheatland Tube Co., Southwire Co. shall

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manufacture intermediate metal conduit or Engineer approved equal.

- D. Flexible Steel Conduit
 - 1. All flexible steel conduits shall be hot dipped galvanized coated bears a NRTL label and shall conform to Federal Specifications WW-C-566C.
 - 2. Triangle PWC, American Flexible Conduit Co., Inc., Anaconda Metal Hose, shall manufacture all flexible steel conduits or Engineer approved equal.
- E. Liquid-tight Flexible Steel Conduit
 - 1. All liquid-tight flexible steel conduit shall be interlocking flexible galvanized steel conduit with a special polyvinyl chloride covering extruded over the flexible conduit to make the conduit liquid-tight resistant to moisture, oil, chemicals and corrosive fumes.
 - 2. Anaconda Metal Hose, O-Z/Gedney, Triangle PWC shall manufacture all liquid-tight flexible steel conduits, or Engineer approved equal.
- F. PVC Plastic Conduit
 - 1. All PVC conduits shall be schedule 40 heavy wall duct. Conduit shall be composed of high impact PVC (Polyvinyl Chloride-C-200 compound) and shall conform to industry NEMA Standards and be NRTL listed for underground and exposed use. Material shall have tensile strength of 7,000 psi at 73.4°F, flexural strength of 11,000 psi, compression strength of 8,600 psi, and minimum wall thickness in various sizes.
 - 2. All conduit fittings, couplings, terminal adapters, junction boxes and necessary fittings shall be of the solvent welding material.
 - 3. Carlon, Can-TEX, Triangle PWC Inc., shall manufacture all PVC conduits or Engineer approved equal.

2.02 CONDUIT HANGERS AND SUPPORTS

- A. Surface Mounted Conduits
 - 1. Rigid steel, IMC and EMT conduits 1 inch and smaller shall be supported with hot dipped galvanized one hole steel pipe straps.
 - 2. Rigid steel, IMC and EMT conduits 1 1/4 inches and larger shall be supported with hot dipped galvanized one hole malleable iron pipe straps with pipe spacers.
 - 3. Raco, Efcor, T & B, Appleton shall manufacture all pipe straps, or Engineer approved equal.
- B. Suspended Conduits
 - 1. Individual rigid steel, IMC and EMT conduit 1 inch and smaller shall be supported with conduit clips of high carbon spring steel or zinc plated steel and support 100 pounds static load. Conduit clip shall be provided with 1/4" 20 threaded impression for attachment to 1/4 inch 20 threaded rod.
 - 2. Individual rigid steel, IMC and EMT conduit 1 1/4 inches and larger shall be supported with stamped steel conduit clamps with 1/4 inch 20 bolt and nut and support 150 pounds static load. Provide conduit clamps with 3/8 inch 16 threaded boss for attachment to 3/8 inch 16 threaded rod.
 - 3. Support two or more rigid steel, IMC or EMT conduits adjacent to each other by 1 5/8 inches by 1 5/8 inches metal framing channel with minimum of two 1/2 inch 13 threaded rod at each end. Attach conduits to metal framing channel with electro-galvanized split pipe clamps with screw and nut.
 - 4. Raco, Efcor, T & B, Appleton shall manufacture conduit clips and clamps, or Engineer approved equal.
 - 5. Unistrut, Super Strut, Kindorf shall manufacture metal framing channel and split pipe clamps, or Engineer approved equal.
 - 6. Conduit shall not be supported from plumbing lines or ductwork.
- C. Anchors
 - 1. Toggle bolts or spider type expansion anchors shall be used for hollow masonry.
 - 2. Lead expansion anchors or preset anchors shall be used for solid masonry.
 - 3. Self-drilling anchors or preset anchors shall be used for concrete.
 - 4. Machine screws, bolts, self-tapping screws or welded studs shall be used for metal.
 - 5. Wood screws shall be used for wood.

2.03 CONDUIT FITTINGS

- A. All conduit fittings and box connectors shall be strong in construction and shall be of such material and finish as not to cause any chemical reaction between itself and the conduit or outlet box which it is fastened or supported.
- B. All conduit fittings and box connectors shall be listed by a NRTL.

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- C. Insulated throat fittings are only required on conduits 2" and larger.
- D. All conduit fittings, box connectors and lock nuts shall be of steel or malleable iron materials.
- E. Fittings for EMT shall be set compression type, rain-tight and concrete-tight. Connectors, couplings, locknuts and other fittings for rigid steel heavy wall and IMC conduit shall be threaded type.
- F. Connectors specified in this paragraph can be zinc plated steel in lieu of malleable iron.
- G. Liquid-tight flexible conduit connectors shall be steel or malleable iron compression type with insulated throat and "O" ring assembly.
- H. Fittings for flexible conduit or liquid-tight flexible conduit shall be of the straight 45 degree or 90 degree connectors and approved for grounding purposes.
- I. Provide expansion joint fittings where expansion joints are shown on architectural drawings.

2.04 BOXES AND COVERS

- A. All junction boxes pull boxes, fixture outlet boxes and switch boxes shall be listed by a NRTL.
- B. All boxes and covers shall meet all requirements of the National Electrical Code.
- C. All boxes and covers shall be made of code gauge steel.
- D. All boxes shall be of proper size and shape for all conduits and conductors entering them.
- E. Install device boxes with bracket attached to box and wall stud to eliminate movement of box in wall.
- F. All boxes installed in poured concrete, block, brick or tile shall be masonry type.
- G. All multiple gang switch boxes of more than three-gang shall be solid gang box.
- H. Surface mount boxes on the ceiling are not required to be FS or FD type boxes. Stamped steel boxes are acceptable for boxes on the ceiling.
- I. Where two or more conduits enter a box, the minimum size of boxes shall be 4 inches by 4 inches by 1 1/2 inches minimum depth. For single device installation, install square cut single device cover.
- J. Install all device boxes with square cut device covers for number of devices required.
- K. All boxes shall have tapped hole for 10-32 ground screw.
- L. Raco, Steel City, Appleton shall manufacture boxes and covers, or Engineer approved equal.

2.05 CABLE AND WIRE

- A. All wire shall have copper conductors and be listed by a NRTL.
- B. Service entrance conductors shall be 600 volts insulation type XHHW-2 90°C. All other wire shall be 600 volts insulation type THWN 90°C insulation for sizes No. 6 to 500 MCM and type THHN 90°C insulation for sizes No. 12 to No. 8.
- C. Under ground wire to pole mounted light fixtures shall be type USE in conduit.
- D. Provide long barrel, NEMA 2 hole copper compression connectors for all cables connected to the padmounted transformer. Make all connections with stainless steel hardware.
- E. All pulling lubricants shall be water based, no exceptions.
- F. Minimum wire size shall be No. 12 except for internal fixture wire that shall be minimum size of No. 14 type AF, CF or TFN, 300 volt.
- G. All wire (excluding fire alarm and low voltage wiring) shall be stranded, including #12 AWG and #10 AWG

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branch circuit wiring.

- H. All branch circuit wiring and feeder cables for circuits over 20 amperes shall be sized as noted on the drawings. If size is not specifically noted, size all branch circuit wiring and feeder cables in accordance with the National Electrical Code.
- I. Cable and wire not installed in conduit shall be #12 AWG SO or SJO type grounded cord. Cord shall terminate at junction boxes and devices with strain relief cord grids.
- J. Triangle, Crescent, Colleyer, and General Cable shall manufacture all wire, or Engineer approved equal.

2.06 METAL CLAD CABLE

- A. MC cable is not allowed.

2.07 ELECTRICAL WIRING DEVICES

- A. All devices are specified as having black finish in wood, white finish if in drywall. The Engineer reserves the right to change the color.
- B. Furnish all special outlets with mating caps with cord grips.
- C. Schedule of all electrical devices:
 - 1. Single Pole Switch - 20 amperes at 120 volts
 - a. Hubbell DS120 (P&S and Plug tail approved equal)
 - 2. Three Way Switch - 20 amperes at 120 volts
 - a. Hubbell DS320 (P&S and Plug tail approved equal)
 - 3. Four Way Switch - 20 amperes at 120 volts
 - a. Hubbell DS420 (P&S and Plug tail approved equal)
 - 4. Duplex Convenience Outlet - 20 amperes at 120 volts
 - a. Hubbell DR20 (P&S and Plug tail approved equal)
 - 5. Duplex Convenience Tamper Resistant Outlet - 20 amperes at 120 volts
 - a. Hubbell D20TR
 - 6. Duplex Convenience Outlet - GFI - 20 amperes at 120 volts
 - a. Hubbell GF20
- D. Forward submittals to Engineer for review.

2.08 WIRING DEVICE PLATES

- A. All device plates shall be furnished with proper openings for the device with which it is being used. Where required, multiple gang plates for correct combination shall be used.
- B. Device plates shall fit tight against the finished walls and shall completely cover the openings in the walls for the boxes.
- C. Device plates shall be attached and adjusted so they finish straight and level.
- D. Where more than one light switch is gained or a light switch and outlet are installed in a two gang box, install multiple gang device plates with proper openings.
- E. Provide 1/2 inch raised galvanized device covers where used for exposed conduit work.
- F. All device plates shall be black if located on wood and stainless steel if located on drywall, with the proper openings for the device with which they are being used.
- G. All device plates for exterior weatherproof outlets and switches shall be lockable. Cover shall meet NRTL WDL "in use" listing requirement. Cover shall be suitable for standard boxes or FS type boxes.
- H. Mounting screws for all plates shall have the same finish as the plate.
- I. The same manufacturer shall furnish all device plates as devices for proper color match except stainless steel covers.

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J. Forward submittals to Engineer for review.

2.09 SEALS

- A. Fire Seal:
 - 1. Seal penetrations of fire-rated walls, floors or ceilings by raceways for compliance with NEC 300-21. Fill void around raceway. Sleeves shall be heavy wall steel pipe, anchored to building construction and finished plug with wall or ceiling. Fire stop material shall be Dow Corning #6548 Silicone RTV Foam, Chase Technology Corp, CTC PR-855 fire resistant foam sealant, 3M 303 Fire Barrier, T & B S-101 Fire Barrier or Nelson Flameseal.
 - 2. Must be listed as part of a NRTL approved assembly.
- B. Water Seal:
 - 1. Seal penetrations of perimeter walls or floors below grade to prevent entry of water. Use materials compatible with wall or floor construction and approved by Engineer.
 - 2. Seal all conduit penetrating air handling units air tight including conduit installed by the air handling unit manufacturer.

PART 3 - EXECUTION

3.01 SPACE PREFERENCE

- A. Carefully verify and coordinate the location and level of all lines. Run preliminary levels and check with all other contractors so that conflict in location may be avoided.
- B. If conflicts occur, the following preference schedule shall be followed:
 - 1. Recessed electric fixtures
 - 2. High-pressure duct work
 - 3. Soil and waste piping
 - 4. Domestic water piping
 - 5. Low-pressure ductwork
 - 6. Domestic water storm and vent lines.
 - 7. Electric conduits
- C. No other work shall have preference over plumbing lines below fixtures.
- D. No other work shall have preference over conduit above or below electric switchgear and above or below panels.
- E. No piping conveying fluids shall be provided directly over electrical, communications or elevator equipment.

3.02 FIELD CORRECTIONS AND CHANGES

- A. Carefully and accurately record on field set of drawings, any deviations or changes in location of conduit, wiring and/or equipment made in the field and shall keep the Engineer informed on all deviations and changes.
- B. At the completion of the job, furnish the Engineer three complete sets (not the field set) of drawings indicating these deviations or changes. Extra sets of drawings will be provided to the contractor for this purpose. Any changes in the exterior work shall be recorded by dimension.

3.03 LOCATION OF EQUIPMENT

- A. The approximate location of all equipment is shown on the drawings.
- B. The Engineer reserves the right to change the location of all equipment 5 feet in any direction without these changes being made the subject of an extra charge provided such changes are made before final installation.

3.04 LINES AND LEVELS

- A. Determine all grades, maintain necessary lines and levels throughout the progress of the work, and assume full responsibility for their correctness. Where levels are indicated on the drawings, work shall be installed at those levels unless prior written approval to change is obtained from the Engineer.

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3.05 CLEANING

- A. Upon completion of the contract all remaining materials and rubbish shall be removed from the building and premises and the work areas shall be left clean and free from stains, mortar, paint spots, etc.
- B. All switches, controls, and safety devices shall be clearly and permanently marked with embossed or printed plates as to purpose and as to operation and shall be tested in the presence of the Owner's designated representative to insure that their function and purpose is understood.
- C. Upon completion of the work, put systems into service maintaining responsibility for the equipment during all testing operations including turning on and off of such apparatus.

3.06 OPENINGS IN NEW CONSTRUCTION

- A. Openings required in new construction for Division 26 Work will be provided by the General Contractor at the request of and in accordance with information furnished by the Electrical Contractor. The General Contractor will advise the Electrical Contractor in advance so that he may lay out the required openings. If said Electrical Contractor fails to lay out required openings, he shall be financially responsible for the necessary cutting, patching and repairing. The General Contractor will do the patching and repairing.

3.07 WALL AND FLOOR SLEEVE INSTALLATION

- A. Set all wall and floor sleeves during the construction of the portion of the new construction through which the piping is to pass.
- B. Provide sleeves of black iron pipe and of proper size to accommodate raceway. Install sleeves flush with walls and ceilings. Coordinate locations of sleeves with other trades to avoid interferences with their work.
- C. Anchor all sleeves properly to the building construction.
- D. Set floor sleeves plumb, wall sleeves level and center all piping in sleeves.
- E. Care shall be taken to set sleeves in formwork and check all dimensions before concrete is poured.
- F. Extend floor sleeves in finished areas 1/2 inch above finished floor and neatly level top of sleeve.
- G. Finish all wall sleeves flush with wall lines unless otherwise specified.
- H. Where sleeves occur in exterior walls above grade, caulk sleeves with sealant.
- I. Where sleeves occur in exterior walls below grade, caulk sleeves with oakum and lead wool.
- J. Openings between sleeves and conduit through fire or smoke barriers shall be closed with fire stop material to maintain fire or smoke barrier rating.
- K. All occupied and unoccupied conduit sleeves in closet shall be fire stop after cable or conduit is in place. Occupied conduit sleeves shall be fire stopped with fire stop material and unoccupied conduit sleeves shall be fire stopped with metal caps on both ends.

3.08 PROTECTION OF WORK

- A. Protect work from damage by keeping all conduit and boxes capped and plugged or otherwise protected. This includes damage by freezing and/or stoppage from building materials, sand, dirt or concrete.

3.09 INSTALLATION

- A. Coordinate with other contractors engaged in project. Execute work in a manner not to interfere with other contractors or Owner's operation.
- B. Coordinate work with other contractors regarding location and size of pipes, raceways, ducts, openings, switches, outlets, so there is no interference between installations or of progress of any contractor.
- C. Install all equipment with ample space allowed for removal, repair, or changes to equipment. Provide ready accessibility to removable parts of equipment and to all wiring without moving equipment installed or already in

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place. Provide access panels for all devices installed above non-accessible ceilings or within walls or partitions.

D. At project completion, clean all equipment to the original finish. Remove all shipping labels.

E. Provide touch-up painting of all equipment marred in any way during shipment or installation.

3.10 INSTALLATION OF RACEWAYS AND CONDUITS

- A. All raceways shall be concealed in wall construction and/or above ceiling construction except in mechanical equipment rooms, where it may be exposed at the ceiling or on walls.
- B. There shall not be any branch circuit conduits installed horizontally in the concrete floor slabs throughout the building, except where specifically shown on the drawings.
- C. In mechanical and electrical equipment spaces, expose ceiling outlets and conduit with due consideration to ventilating ducts and mechanical piping. Where numerous ducts occur, install conduits and outlets after ventilating ducts. Puncturing of ductwork or hanging equipment such as light fixtures, ceiling hangers, conduit, from ductwork, is prohibited, unless specifically noted otherwise.
- D. Lay out all partitions on the project, for proper rough-in locations of all boxes and conduits. Verify all partition locations, door swings, cabinet locations before roughing in, and make any/all changes necessary to ensure that all switches, outlets, systems equipment, rough-ins are located properly. Any changes necessary in locations and rough-ins, due to a partition change and this contractor's failure to coordinate and verify same, shall be made.
- E. The routing of conduit shown on the drawings is diagrammatic only, and this contractor shall install conduit as required to complete the systems so as not to interfere with other trades in both elevation and location.
- F. The location of all conduit, boxes, fixtures, etc., in all areas finished and unfinished shall be coordinated.
- G. Route conduit through roof openings for piping and ductwork where possible. Provide flashing making waterproof joints where conduits pass through roof or roofing membrane.
- H. Provide conduit expansion joints at building expansion joints for conduit runs 1 1/2 inches and larger. Provide conduit expansion joints or flexible conduit connection at building expansion joints for conduits less than 1 1/2 inches.
- I. Conduit shall be a minimum of 3/4 inch unless otherwise noted on the drawings.
- J. All conduit bends shall be long radius with not more than the equivalent of three 90-degree bends between pull points.
- K. Provide all open ends of conduit with bush caps to exclude any foreign material during construction.
- L. All conduits installed in or under concrete or underground shall have joints sealed to exclude all water or other foreign material.
- M. Coordinate the installation of all conduits in mechanical equipment spaces or where large amounts of ductwork and piping are present, with the other contractors so as to avoid interferences.
- N. Unless otherwise noted on the drawings, size all conduits according to the National Electrical Code.
- O. Install all exposed conduits parallel or perpendicular to adjacent walls, ceilings or floors.
- P. All conduit couplings and fittings shall be made up wrench tight.
- Q. Make all conduit systems mechanically and electrically continuous from source of current to all outlets, and ground in accordance with the National Electrical Code.
- R. Where building construction or other conditions make it impossible to use standard threaded couplings, install watertight threaded unions.

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- S. Install rigid steel conduit for the following:
 - 1. All conduit in poured concrete construction (unless noted as PVC).
 - 2. All conduit underground (unless noted as PVC).
 - 3. All conduit exposed in exterior areas.
 - 4. All conduit installed through foundation or basement wall, below grade, to a minimum of 10'0" beyond wall.
 - 5. All service entrance conduit and all exterior conduit larger than 2" trade size.
- T. Install electrical metallic tubing (thin wall) conduit for the following:
 - 1. All conduits in block, brick, tile or stud walls.
 - 2. All feeders for panelboards and distribution equipment.
 - 3. All conduit exposed in interior areas.
- U. Install flexible steel conduit for the following:
 - 1. Final connections for all recessed lighting fixtures (fluorescent and incandescent).
 - 2. All vibration generating equipment except where flexible liquid-tight is specifically called for.
 - 3. A maximum length of flexible steel conduit shall be limited to 6'0".
- V. Install liquid-tight flexible steel conduit for the following:
 - 1. Final connections to all motors, except exhaust fans in ceiling space and wall 1/8 horsepower and less.
 - 2. All vibration generating equipment exposed to exterior conditions.
 - 3. Maximum length of liquid-tight flexible conduit shall be limited to 6'0".
- W. Install PVC conduit for the following:
 - 1. All conduit for underground exterior circuits 2" and smaller. PVC conduit shall be complete with all accessories, such as, couplings, male and female adapters, expansion couplings, elbows and support straps. Install one expansion coupling for every 100 feet of run, or in any run solidly connected at both ends. Use solvent welding cement recommended by the duct manufacturer, for all conduit terminations at fittings of all types to seal and secure the connections. Support the plastic conduit horizontal conduit runs 4 feet on center and vertical runs every 8 feet.
- X. Communications
 - 1. Minimum communications raceway size to be 1" conduit, unless otherwise noted on drawings.
 - 2. Provide one conduit from each communications box. Horizontal conduit runs between wall boxes are not allowed.
 - 3. Provide insulated grounding bushings on end of conduit.
 - 4. Provide flush two-gang box with single gang plaster ring for each communications outlet or as noted on drawings.
 - 5. Conduit bends to be no less than 10 times outside diameter of conduit.
 - 6. Conduits shall have no more than (2) 90 degree bends or total of 180 degree bends or offsets without a pull box. Pull boxes shall be installed in accessible locations.
 - 7. No underslab installations allowed.

3.11 RACEWAY SUPPORTS AND HANGERS

- A. Securely fasten raceways in place and support from ceiling or walls.
 - 1. Maximum Spacing of Supports

	Material
a. 1/2" through 1" trade size	6 feet
b. 1 1/4" through 1 1/2" trade size	8 feet
c. 2" through 4" trade size	10 feet
d. Flexible metal conduit	4 1/2 feet
- B. Support IMC or EMT conduit within three feet of every outlet box, junction box, pull box, cabinet or termination. Support flexible conduit within 12 inches of every outlet box or fitting.
- C. Support vertical runs or conduits at each floor level and at interval not to exceed ten feet.
- D. Support conduits by pipe straps, wall brackets, hangers, or ceiling trapeze. The use of perforated iron on wire for supporting conduits is prohibited. Fasten with wood screws or screw nails to wood; by toggle bolts on hollow masonry units, by concrete inserts, or expansion steel conduits on steel. Do not weld conduits or pipe straps to steel structures unless specifically indicated.
- E. The load applied to fasteners shall not exceed one-third the proof test load of the fasteners.

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- F. For fasteners attached to concrete, use vibration and shock resistant.
- G. In partitions of light steel construction, use sheet metal screws.
- H. Conduit shall not be supported from suspended ceiling hangers, ductwork or plumbing lines.
- I. Where two or more conduits one inch trade size or larger run parallel, trapeze hangers may be used consisting of threaded solid rods, washers, nuts and galvanized "L" angle or channel iron. Individually fasten conduits to the cross member of every other trapeze hanger with one hole straps or clamp backs with proper size bolts, washers and nuts. When adjustable trapeze hangers are used, use U-bolt type clamps at end of conduit runs, at each elbow and at each third intermediate hanger to fasten each conduit.
- J. Make hangers of durable materials suitable for the application involved. Applied loads shall not exceed one-third of their loading capacity.
- K. Fabricate all screws, bolts, washers and miscellaneous hardware used for conduit supports from rust-resisting metal. Trapeze hangers shall have hanger assemblies' protected galvanized finish.

3.12 INSTALLATION OF BOXES

- A. Provide pull boxes, junction boxes or outlet boxes as shown on the drawings and/or in all runs of conduit having the equivalent of three 90 degree bends or more than 100 feet in length.
 - 1. Communications conduit runs shall have no more than 100 linear feet and/or no more than two (2) 90-degree bends without a pull box.
 - 2. Do not provide pull box in lieu of 90-degree bend for communications cable.
 - 3. LB type fittings are not to be used for communications cable.
- B. Location of outlets shown on the drawings is diagrammatic only. Coordinate exact location of outlets with architectural details, equipment connection requirements and all ceiling outlets with due consideration to clearance from ventilating ducts and piping.
- C. Locations of all junction boxes shall be verified on the job.
- D. All junction boxes shall be installed so that they are accessible by removing an access door, recessed fixture, coverplate, etc.
- E. Where flush coverplates are required in finished areas, they shall be painted to match adjacent wall or ceiling finishes.
- F. All junction boxes, other than for power or lighting, shall be identified as to their usage; such as, television, telephone, door security, fire alarm, etc., by permanently attached labels on the inside or outside of the coverplate.
- G. Power and communication outlets shall not be installed in the same junction box.

3.13 METHOD OF WIRING

- A. Install all the conductors in conduits.
- B. Equipment and devices installed and not constructed with cases especially suited for mounting and enclosing all live parts shall be installed in metal cabinets.
- C. A complete metal raceway or enclosure shall be provided for all circuiting throughout the extent of the systems specified.
- D. Make conductors continuous from outlet to outlet. Do not make splices except in outlet or junction boxes. Make all feeder cables continuous from origin to panel or equipment terminations without running splices in intermediate pull or boxes, unless specifically indicated on the drawings or approved in writing by Engineer.
- E. Blow out and swab all conduit until all moisture and grit is removed before any wires are pulled or installed. Use water-based pulling lubricant, compatible with insulation and covering, that will not cause deterioration of insulation or jacket covers of cables on conductors. Use pulling lubricant recommended by wire manufacturer.

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- F. Provide each cable or conductor in panels, pullboxes or troughs with a permanent pressure-sensitive label with suitable numbers or letter for easy identification. Identify control wires at each end and in junction boxes with designated wire numbers corresponding to control schematic drawings.
- G. Provide wires and cables entering equipment or panels with enough slack to eliminate stretched, angular connection. Neatly arrange wiring, bundle and fan out to termination panels. Make minimum bending radius for conductors in accord with National Electrical Code.
- H. Support all conductors in vertical raceways in accord with National Electrical Code.
- I. Leave at least six-inch loops or ends at each outlet for installation of devices or fixtures. Roll up all wires in outlet boxes not for connection to fixture or device at that outlet, connect together and tape.
- J. Size all branch circuit wiring for circuits over 20 amperes as shown on the drawings and/or as required by the National Electrical Code. All home run branch circuit wiring from the first outlet, fixture or device on 120 volt, 1 phase, or 277 volt, 1 phase circuit to the panelboard shall conform to the following wire sizes for amp circuits unless otherwise noted on the drawings:
 - 1. 120-VOLT CIRCUITS
 - a. 0 to 50 feet #12 wire
 - b. 51 to 100 feet #10 wire
 - c. 101 to 150 feet # 8 wire
 - d. 151 to 200 feet #6 wire
- K. Clarification to the color-coding of conductors is as follows: For all voltages and systems equipment grounds shall be green, isolated grounds shall be green with yellow stripe or with yellow tape bands and travelers for 3-way switches shall be violet.
- L. At the Electrical Contractor's option, the three phase power circuits and feeder cables can be installed with color-coded conductors or with three conductors of the same color. If they are installed with the same color of insulation, mark with colored tape in the panelboard and starter.
- M. Phase all distribution equipment left-to-right, A, B, and C for continuity of phasing throughout the installation.
- N. All stranded cables shall terminate into mechanical type or compression type lugs at termination points.
- O. Neatly group all circuits in all distribution equipment and tie with Seine Twine, Ty-Rap or Wrap Tabs.
- P. Special care shall be taken to balance connections of circuit wires on different phases at the lighting panelboards using distinguishing colors for identifying the particular phase on which the circuit belongs.
- Q. In general, lighting and outlet circuits shall distribute from single pole 20-ampere breakers, 2 wire with solid neutral. Where noted on drawings, run single phase or 3 phase power circuits from two or three pole breakers.
- R. A separate neutral conductor shall be pulled for each phase conductor for all 120 volt and 277 volt branch circuits. Common neutrals are not allowed. Provide color tracer matching phase conductor.

3.14 WIRING JOINTS

- A. Joints in conductors shall be as few in number as practicable and where they are necessary they shall be mechanically strong, well made and shall provide complete electrical contact.
- B. Joints shall be so made that they have an electrical resistance not in excess of that of two feet of the conductor.
- C. Make all branch circuit joints for wire up to and including No. 10 AWG with expandable steel spring and polypropylene body type connectors and wire nuts manufactured by Ideal, Scotch, Buchanan or Engineer approved equal.
- D. Make all wire splices in wire No. 6 and larger with mechanical compression crimp type connectors of proper size and wire configuration. Cover all connectors with a minimum of three layers of 600 volts tape or heat shrinkable insulation equivalent to 150 percent conductor insulation.
- E. Neutral conductors in outlet boxes at receptacles shall be jointed and pigtailed to the outlet. The removal of a receptacle from the circuit shall not affect the continuity of the neutral conductor.

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3.15 HEIGHTS OF WALL SWITCHES AND RECEPTACLES

- A. Determine the exact height of each light, receptacle outlets, and outlet boxes on the premises and examine the general drawings and details to see that outlets are properly spaced and located with relation to the interior finish and treatment.
- B. In order that all outlets may be located in proper relation to paneling and decorated areas, become familiar with the details of these areas. Consult with the other contractors on the project and procure all details of the various areas so as to make the outlet boxes and panelboards come in proper relation to the work of all other contractors. Be responsible for the exact and proper location of the various portions of work. Such work must be entirely satisfactory to the Engineer.
- C. Mounting heights of devices shall comply with ADA. The following is a list of mounting heights for equipment:
 - 1. Locate wall switches 3'6" above the floor, except where special treatment requires a higher or lower setting.
 - 2. Locate receptacles as follows:
 - a. In general, locate 18 inches above finished floor except as hereinafter specified or as indicated on the architectural drawings.
 - b. In block walls, locate either in the bottom or top of the nearest block course.
 - c. In brick walls, mount in the horizontal position, in the fourth brick course.
 - d. In spaces where noted to be above counters, mount in the horizontal position, 4 inches from backsplash to bottom of box.
 - e. In rooms that house mechanical and electrical equipment, locate 40 inches above finished floor.
 - f. Locate weatherproof receptacles 24 inches above finished grade.
 - 3. F.A. Speakers and Visual Indicators: 84" above finished floor to bottom of device.
 - 4. F.A. Pull Stations: 3'6" above finished floor to center of device.
 - 5. Disconnect Switches: 5'0" above finished floor.
 - 6. Manual and Magnetic Starters or Pushbutton Controls: 5'0" above finished floor.
 - 7. Telephone/Data Outlets: Same as receptacles above.
- D. All of the above mounting heights shall be held as near as possible to the center line of the equipment.
- E. The above list is general in nature. Examine all Architectural Drawings and consult with the Engineer and vary mounting heights as directed.

3.16 TESTING 600 VOLT

- A. After wires and cables are in place and before connection to the devices and equipment is made, test the system for shorts and grounds by means of an approved type of constant potential "Megger", which is to be furnished by the Electrical Contractor.
- B. Remove and replace all hot wires if shorted or grounded.

END OF SECTION

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**SECTION 26 51 00
LIGHTING**

PART 1 - GENERAL

1.01 WORK INCLUDES

- A. Light fixtures.
- B. Lamps.
- C. Ballast.
- D. Fixture bases.
- E. Fixture lens.
- F. Accessories.

1.02 QUALITY ASSURANCE

- A. All fixtures shall have UL label.
- B. Ballasts shall be in accord with ANSI Standards.
- C. Comply with:
 - 1. NFPA - 70
 - 2. I.E.S.
- D. Verify the ceiling trim requirements for fixtures to assure proper installation for the type of ceiling construction.

1.03 SUBMITTALS

- A. Submit manufacturer's data demonstrating compliance with this specification and the schedule on the drawings.
- B. Shop Drawings:
 - 1. Include data specified herein including fixture "mark" corresponding to the Drawings.
 - 2. Clearly indicate type and color of each lamp(s) to be used for each fixture type.
 - 3. Submit shop drawings for each type of lamp.
- C. Submittals will be reviewed a maximum of three revisions. If after the third submission submittal package does not conform to Specifications herein, CONTRACTOR will be billed at Electrical Engineer's standard hourly rate.
- D. Maintenance data for fixtures to include in the operation and maintenance manual specified in Division 1.

PART 2 - PRODUCTS

2.01 FIXTURE SCHEDULE

- A. Light fixtures shall be as listed on the drawing Fixture Schedule.
- B. The various types of fixtures to be provided are indicated on the drawings. A fixture shall be provided for each ceiling outlet, bracket outlet and other lighting fixture outlets. Where a fixture type is not indicated, provide a fixture of the same type used in similar areas.

2.02 FIXTURES

- A. Where installed on combustible surfaces, fixtures shall be specifically UL listed for this condition or be spaced not less than 1-1/2-inch from the combustible surface.

- B. All glassware shall be high quality, homogeneous in texture and free from streaks, cords, stones, or blisters and of uniform thickness and properly annealed.
- C. Enamel finish shall be baked. The finish of each fixture shall be uniform in quality, durable and free from defects.
- D. All plastic molded lenses shall be acrylic prismatic K19, 0.156" type.
- E. Disconnecting Means:
 - 1. All applicable luminaires must be provided with means to comply with luminaire disconnect requirements specified in NEC 410.130(G), 2011 Edition.

PART 3 - EXECUTION

3.01 FIXTURE INSTALLATION

- A. Light fixtures for all outlets shown on the drawings shall be furnished and installed complete including the assembly, wiring, support materials, and installation of each unit in place. All lenses, glassware and metal parts shall be thoroughly cleaned just prior to final acceptance.
- B. Lighting fixtures shall be mounted as specified, and shall include all necessary fittings for a complete installation. Provide all materials to adequately and safely support all fixture installations.
- C. Verify ceiling suspension material and systems in the various areas and provide plaster frames and proper fixture trims.

3.02 FIXTURE LOCATION

- A. Space fixtures as indicated on the drawings and in keeping with ceiling patterns, air inlets and outlets.
- B. Light fixtures recessed in ceiling shall be coordinated with ceiling construction. Recessed fixtures as scheduled serve only as a guide as to the type of fixture, lamp, and lens. Supply fixture that shall integrate with the type of ceiling as scheduled on architectural drawings approved for construction. Recessed light fixtures installed in grid ceiling shall have tee grid clamps.
- C. Exit lights shall be coordinated with adjacent architectural work and shall be located and modified as to type of mounting, as directed by Architect/Engineer.

3.03 FIXTURE SUPPORT

- A. Conduits run to recessed fixtures shall terminate in a suitable box adjacent to fixture opening with final connections to fixture made with flexible conduit and Type AF wire. Airtight fiberglass gaskets shall be provided around recessed fixtures to eliminate light leakage or hot air dirt streaks between fixture trim and finished ceiling. Fixtures shall be designed, insulated and ventilated to prevent scorching of adjacent construction. Plaster or other special frames, including extension pan for exposed conduit installation, shall be provided.
- B. Light fixtures shall have proper supports, flanges, and plaster frames to integrate with the type of ceiling construction. All fixtures shall be constructed so that they may be securely supported. All fixtures shall be supported from 3/8-inch stud in outlet box. Outlet boxes shall have fixture studs and shall be securely hung independently of conduits.
- C. Provide auxiliary supports for mounting fixtures in areas without ceilings (i.e., exposed beams and slabs), for proper installation of fixtures. Such supports shall span a minimum of 2 beams for each individual fixture and shall be securely and suitably anchored.
- D. Fixtures shall be supported with a stem and "L" hanger on one end and pipe stem on the other end. When conduit is used to support fixtures, 1-inch rigid heavy wall shall be the minimum size. When conduits are used as stems, locknuts and washers shall be employed. Conduit may not be reduced in size between fixtures.

- E. Fixtures installed adjacent to unit heaters or mechanical equipment, which may cause fixtures to vibrate, shall be installed so not to sway.
- F. Fixtures shall not be supported from underside of metal roof decks, except where specifically noted otherwise on the drawings.
- G. Compression or indenter type couplings will not be acceptable for fixtures supports.
- H. Recessed grid fixtures shall be provided with T-bar clips. Install 4 per fixture.
- I. Fixtures installed in continuous rows shall be supported a minimum of 8'-0" on center. Where fixtures are mounted in continuous rows over 16 feet long, support from Kindorf, Unistrut, or Storack which will limit deflection to acceptable values. When channels are used for a wireway, thus eliminating conduit shown on the drawings as running parallel to the channels. Channels shall have closure plates if used as wireways. Continuous wireways may be used in place of conduit when approved in writing by Architect/Engineer for the installation.
- J. In general, support all fluorescent fixtures from the building structure and not from the ceiling suspension system (such as tee bar system for a suspended acoustical tile ceiling.)
- K. At the Electrical Contractor's option recessed fluorescent fixtures can be supported from the ceiling suspension system if the Electrical Contractor makes arrangements and pays for additional ceiling hanger wires of adequate strength and quantity to support the fixtures. Where recessed fixtures occur in grid system, install tie wires on all four corners of the grid system about the fixture. Fixtures so supported shall be securely fastened to the grid system members with safety tee bar clips.

3.04 MISCELLANEOUS REQUIREMENTS

- A. Color of exit light lettering shall be green LED. All letters shall be 6 inches high by 3/4-inch stroke. Exit signs at an egress shall read "EXIT".
- B. Fixtures marked "WP" shall be waterproof with special waterproof boxes and gaskets as required to keep rain or hose spray from coming into contact with wiring.
- C. Letters "a", "b", "c", etc., indicate associated switch or switches. Figures "1", "2", "3", etc., indicate associated branch circuit. "F1", "F2", "F3", etc. indicate fixture type.

3.05 LAMP INSTALLATION

- A. Provide all lamps for all outlets and fixtures. All fixtures shall be complete with lamps and in operating condition when the building is turned over to the Using Agency. All "burnt out" or broken lamps that occur during the construction period shall be replaced.
- B. All fixtures, reflectors, lenses, and lamps shall be cleaned.

END OF SECTION

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