

ALL TRADES SPECIFICATIONS

VAN BUREN TOWNSHIP
DOWNTOWN DEVELOPMENT AUTHORITY
2016 PLACEMAKING PROJECT
PROJECT NUMBER: 161675
FEBRUARY 9, 2018

PROJECT

VAN BUREN TOWNSHIP DOWNTOWN DEVELOPMENT AUTHORITY 2016 PLACEMAKING PROJECT

DESIGN BUILD CONTRACTOR

Axiom Construction Services Group
7789 E M-36
Whitmore Lake, MI 48189

OWNER

Van Buren Township Downtown Development Authority
46425 Tyler Road
Van Buren Twp, MI 48111

ARCHITECT

Wakely Associates, Inc.
30500 Van Dyke Ave., Suite 209
Warren, Michigan 48093

SPECIFICATIONS

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VAN BUREN TOWNSHIP DOWNTOWN DEVELOPMENT AUTHORITY
2016 PLACEMAKING PROJECT

OWNER

VAN BUREN TOWNSHIP DOWNTOWN DEVELOPMENT AUTHORITY
46425 TYLER ROAD
VAN BUREN TOWNSHIP, MI 48111

ARCHITECT

WAKELY ASSOCIATES, INC.
30500 VAN DYKE, SUITE 209
WARREN, MICHIGAN 48093
586-573-4100

CIVIL ENGINEER

ENVIRONMENTAL ENGINEERS
18620 WEST TEN MILE ROAD
SOUTHFIELD, MI 48075
248-424-9510

LANDSCAPE ARCHITECTS

PAT CONROY AND ASSOCIATES
P.O. BOX 542
LAKE ORION, MI 48361
248-814-8082

MECHANICAL/ELECTRICAL ENGINEER

STRATEGIC ENERGY SOLUTIONS, INC.
4000 WEST ELEVEN MILE ROAD
BERKLEY, MI 48072
248-399-1900

STRUCTURAL ENGINEER

SNYDER AND STALEY ENGINEERING
3085 JBAY ROAD, SUITE 6
SAGINAW, MI 48063
989-797-1710

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C2.0 SITE DEMOLITION PLAN
C3.0 SITE UTILITIES PLAN
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SECTION 01090 - REFERENCE STANDARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES:

- A. Quality assurance.
- B. Schedule of references.

1.02 QUALITY ASSURANCE:

- A. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by date of issue current on date for receiving bids.
- C. Obtain copies of standards when required by Contract Documents.
- D. Maintain copy at job site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
- F. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.04 SCHEDULE OF REFERENCE:

- AA Aluminum Association
900 19th Street, N.W. - Suite 300
Washington, DC 20006
- AABC Associated Air Balance Council
1518 K Street N.W.
Washington, DC 20005

AASHTO American Association of State Highway
and Transportation Officials
444 North Capitol Street, N.W. - Suite 249
Washington, DC 20001

ACI American Concrete Institute
P.O. Box 9094
Farmington Hills, MI 48333-9094

ADC Air Diffusion Council
1901 N. Roselle Rd., Suite 800
Schaumburg, IL 60195

AF&PA American Forest & Paper Association
1111 19th Street, NW, Suite 800
Washington, DC 20036

AGC Associated General Contractors of America
2300 Wilson Blvd., Suite 400
Arlington, VA 22201

AI Asphalt Institute
2696 Research Park Drive
Lexington, KY 40511-8480

AIA American Institute of Architects
1735 New York Avenue, N.W.
Washington, DC 20006-5292

AISC American Institute of Steel Construction
One East Wacker Drive
Suite 3100
Chicago, IL 60601-2001

AISI American Iron and Steel Institute
1140 Connecticut Ave - Suite 705
Washington, DC 20036

AITC American Institute of Timber Construction
7012 S. Revere Parkway - Suite 140
Englewood, CO 80112

AMCA Air Movement and Control Association
30 West University Drive
Arlington Heights, IL 60004

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ANSI American National Standards Institute
25 West 43rd Street, Fourth Floor
New York, NY 10036

APA American Plywood Association
Box 11700
Tacoma, WA 98411-0700

ARI Air Conditioning and Refrigeration Institute
4100 North Fairfax Drive - Suite 200
Arlington, VA 22203

ASHRAE American Society of Heating, Refrigeration and
Air Conditioning Engineers
1791 Tullie Circle, N.E.
Atlanta, GA 30329

ASME American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990

ASTM American Society for Testing and Materials
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959

AWI Architectural Woodwork Institute
46179 Westlake Drive, Suite 120
Potomac Falls, VA 20165

AWPA American Wood-Preservers' Association
P.O. Box 5690
Grandbury, TX 76049

AWS American Welding Society
550 N.W. LeJeune Road
Miami, FL 33126

AWWA American Water Works Association
6666 West Quincy Avenue
Denver, CO 80235

BIA Brick Institute of America
1350 Centennial Park Drive, Suite 301
Reston, VA 20191

CDA Copper Development Association
260 Madison Avenue - 16th Floor
New York, NY 10016

CLFMI Chain Link Fence Manufacturers Institute
10015 Old Columbia Road, Suite B-215
Columbia, MD 21046

CRSI Concrete Reinforcing Steel Institute
933 Plum Grove Road
Schaumburg, IL 60173-4758

CSSB Cedar Shake and Shingle Bureau
P.O. Box 1178
Sumas, WA 98295-1178

DHI Door and Hardware Institute
14150 Newbrook Drive, Suite 200
Chantilly, VA 20151

EJCDC Engineers' Joint Contract Documents Committee
American Council of Engineering Companies
1015 15th Street, N.W., 8th Floor
Washington, DC 20005

EJMA Expansion Joint Manufacturers Association
25 North Broadway
Tarrytown, NY 10591

FGMA Flat Glass Marketing Association
3310 Harrison
White Lakes Professional Building
Topeka, KS 66611

FM Factory Mutual System
Standards Laboratories Department
1151 Boston-Providence Turnpike
Norwood, MA 02062

FS Federal Specification
General Services Administration
Specifications and Consumer Information
Distribution Section (WFSIS)
1800 F Street, NW
Washington, DC 20405

GA Gypsum Association
810 First Street N.W. #510
Washington, DC 20002-4268

ICC International Code Council
5203 Leesburg Pike, Suite 600
Falls Church, VA 22041

IEEE Institute of Electrical and Electronics Engineers
345 East 47th Street
New York, NY 10017

IMIAC International Masonry Industry All-Weather Council
International Masonry Institute
815 15th Street, N.W.
Washington, DC 20005

MBMA Metal Building Manufacturer's Association
1300 Sumner Avenue
Cleveland, OH 44115-2351

MFMA Maple Flooring Manufacturers Association
60 Revere Drive
Northbrook, IL 60062

MIL Military Specification
Naval Publications and Forms Center
700 Robbins Avenue, Building 4, Section D
Philadelphia, PA 19111-5093

ML/SFA Metal Lath/Steel Framing Association
Division of National Association of Architectural Metal
Manufacturers (NAAMM MLIFSA)
600 South Federal Street, Suite 400
Chicago, IL 60605

NAAMM National Association of Architectural Metal
Manufacturers
800 Roosevelt Road, Building C, Suite 312
Glen Ellyn, IL 60137

NCMA National Concrete Masonry Association
2302 Horse Pen Road
Herndon, VA 22071-3499

NEBB National Environmental Balancing Bureau
8575 Grovement Circle
Gaithersburg, MD 20877

NEMA National Electrical Manufacturers' Association
1300 North 17th Street, Suite 1752
Rosslyn, VA 22209

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NFPA National Fire Protection Association
#1 Battery March Park
Quincy, MA 02269-9101

NSWMA National Solid Wastes Management Association
4301 Connecticut Avenue, N.W., Suite 300
Washington, DC 20008-2304

NTMA National Terrazzo and Mosaic Association
201 North Maple, Suite 208
Purcellville, VA 20132

PCA Portland Cement Association
5420 Old Orchard Road
Skokie, IL 60077

PCI Precast Prestressed Concrete Institute
175 W. Jackson Blvd.-Suite 1859
Chicago, IL 60604-9773

PS Product Standard
U.S. Department of Commerce
1401 Constitution Avenue, N.W.
Washington, DC 20230

RIS Redwood Inspection Service
Division of California Redwood Association
405 Enfrente Drive
Novato, CA 94949

SDI Steel Deck Institute
P.O. Box 25
Fox River Grove, IL 60021

SDI Steel Door Institute
c/o Wherry Associates
30200 Detroit Road
Cleveland, OH 44145-1967

SIGMA Sealed Insulating Glass Manufacturers Association
401 N. Michigan Avenue
Chicago, IL 60611

SJI Steel Joist Institute
3127 10th Avenue North
Myrtle Beach, SC 29577-6760

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SMACNA Sheet Metal and Air Conditioning Contractors'
National Association
4201 Lafayette Center Drive
Chantilly, VA 20151-1209

SSPC Society for Protective Coatings
40 24th Street, 6th Floor
Pittsburgh, PA 15222-4656

TCNA Tile Council of North America, Inc.
100 Clemson Research Blvd.
Anderson, SC 29625

TPI Turfgrass Producers International
2 East Main Street
East Dundee, IL 60118

UL Underwriters' Laboratories, Inc.
333 Pfingston Road
Northbrook, IL 60062-2096

WCLIB West Coast Lumber Inspection Bureau
6980 S.W. Varns Road
Tigard, OR 97223

WDMA Window & Door Manufacturers Associations
1400 W. Touhy Avenue, Suite 470
Des Plaines, IL 60018

WWPA Western Wood Products Association
522 SW Fifth Avenue, Suite 500
Portland, OR 97204-2122

PART 2 - PRODUCTS
Not Used

PART 3 - EXECUTION
Not Used

END OF SECTION 01090

SECTION 02070 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section requires the selective removal and subsequent offsite disposal of the following:

1. Portions of existing building indicated on drawings and as required to accommodate new construction.
2. Removal of interior partitions as indicated on drawings.
3. Removal of doors and frames indicated "remove."
4. Removal of existing ceilings indicated and/or required for new construction.
5. Removal of existing paint finishes in areas indicated on the drawings.
6. Removal and protection of existing fixtures, materials, and equipment items indicated "salvage'', "relocated" or "reused''.
7. Removal of existing electrical items as indicated on the drawings.
8. Removal of existing mechanical equipment as indicated on the drawings.

- B. Removal work specified elsewhere:

1. Cutting nonstructural concrete floors and masonry walls for piping, ducts, and conduits is included with the work of the respective mechanical and electrical specification sections in Divisions 15 and 16.
2. Cutting holes in roof deck for installation of new rooftop mechanical equipment is specified in Division 15.

C. Related work specified elsewhere:

1. Remodeling construction work and patching are included within the respective sections of specifications, including removal of materials for reuse and incorporation into remodeling or new construction.
2. Relocation of pipes, conduits, ducts, and other mechanical and electrical work is specified in other Divisions.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Schedule indicating proposed sequence of operations for selective demolition work to the 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.
- C. 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.

1.4 JOB CONDITIONS

- A. Occupancy: A business will occupy buildings immediately adjacent to areas of selective demolition. Conduct selective demolition work in manner that will minimize need for disruption to that business' normal operations. Provide minimum of (72) hours advance notice to Owner's representative and adjacent business(es) of demolition activities that will affect adjacent business(es) normal operations.
- B. Condition of Structures: Owner assumes no responsibility for actual condition of items or structures to be demolished.
 1. 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. Partial Demolition and Removal: Items indicated to be removed but of salvageable value to the Contractor may be removed from structure as work progresses. Transport salvaged items from site as they are removed.
1. Storage or sale of removed items on site will not be permitted.
- D. Protections: Provide temporary barricades and other forms of protection to protect Owner's & Macomb County Health Department personnel and general public from injury due to selective demolition work.
1. Provide protective measures as required to provide free and safe passage of Owner's & Macomb County Health Department personnel and general public to occupied portions of building.
 2. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or work to remain.
 3. Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.
 4. Protect floors with suitable coverings when necessary.
 5. Construct temporary insulated one hour fire rated dustproof partitions where required to separate areas where noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks.
 6. Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces and installation of new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.
 7. Remove protections at completion of work.
- E. Damages: Promptly repair damages caused to adjacent facilities by demolition work.
- F. Traffic: 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.
- G. Flame Cutting: 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.
- H. Utility Services: 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.
- I. Environmental Controls: Use water sprinkling, temporary enclosures, and other methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection.
1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PREPARATION

- A. General: Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of areas to be demolished and adjacent facilities to remain.

1. 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.
2. Cover and protect furniture, equipment, and fixtures from soilage or damage when demolition work is performed in areas where such items have not been removed.
3. Erect and maintain dust-proof partitions and closures as required to prevent spread of dust or fumes to occupied portions of the building.
 - a. Where selective demolition occurs immediately adjacent to occupied portions of the building, construct minimum one-hour dust-proof partitions of minimum 4-inch studs, 5/8-inch type 'x' drywall (joints taped) on occupied side, 1/2-inch fire-retardant plywood on demolition side. Fill partition cavity with sound-deadening insulation.
 - b. Provide weatherproof closures for exterior openings resulting from demolition work.
4. Locate, identify, stub off, and disconnect utility services that are not indicated to remain.
 - a. Provide bypass connections as necessary to maintain continuity of service to occupied areas of building. Provide minimum of (72) hours advance notice to Owner and Macomb County Health Department if shutdown of service is necessary during changeover.

3.2 DEMOLITION

- A. General: 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.
- B. 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.

3.3 SALVAGED MATERIALS

- A. Salvaged Items: Where indicated on Drawings as "Salvage - Deliver to Owner," carefully remove indicated items, clean, store, and turn over to Owner and obtain receipt.
1. Historic artifacts, including cornerstones and their contents, commemorative plaques and tablets, antiques, and other articles of historic significance, remain property of Owner. Notify Owner's Representative if such items are encountered and obtain acceptance regarding method of removal and salvage for Owner.

3.4 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove from building site debris, rubbish, and other materials resulting from demolition operations. Transport and legally dispose off site.
1. 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.
 2. Burning of removed materials is not permitted on project site.

3.5 CLEANUP AND REPAIR

- A. General: Upon completion of demolition work, remove tools, equipment, and demolished materials from site. Remove protections and leave interior areas broom clean.

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DOWNTOWN DEVELOPMENT AUTHORITY
ADMINISTRATIVE & EXHIBIT BLDG

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1. Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start operations. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION 02070

SECTION 02220 - DEMOLITION

PART 1 - GENERAL

1.1 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for demolition of structures, safety of adjacent structures, dust control, and disposal of materials.
- B. Obtain required permits from authorities.
- C. Notify affected utility companies prior to starting work and comply with their requirements.
- D. Conform to applicable regulatory procedures when discovering hazardous or contaminated materials.
- E. Rules, regulations or laws of any controlling Governmental Agency shall govern, when they are more stringent than the requirements of this Section.

1.2 DESCRIPTION

- A. Provide all labor, materials, and equipment necessary for the completion of all Demolition as shown on the Drawings and specified herein.
- B. All on and offsite Work included consists of but is not limited to:
 - 1. Demolition in part or in whole of existing buildings, footings, foundations, structures, and facilities together with subsequent removal of resulting debris.
 - 2. Removal of existing sidewalks, drives, curbs and pavement, as noted.
 - 3. Removal, disconnecting or capping off of existing utilities, underground structures, septic tanks, disposal fields, etc.

4. Removal or clearing of landscaping, trees, brush, debris, and miscellaneous Site elements as indicated on the Drawings, or as required for new construction.
5. Removal from Site and disposal of all excess and unusable material.

1.3 DEFINITIONS

- A. Remove: Remove items from existing construction and legally dispose of them off-site.
- B. Remove and Reinstall: Carefully remove items indicated from existing construction, prepare them for reuse, and reinstall them where indicated. Prior to reinstalling the item, the Contractor shall make a determination as to its soundness. Items which exhibit signs of wear or deterioration shall only be discarded on agreement with the Construction Manager, Architect and Owner.
- C. Remove and Salvage: Remove items from existing construction and deliver them to owner.

1.4 QUALITY ASSURANCE

- A. The Contractor shall visit the Site so that a full understanding of the difficulties and restrictions for execution of the Contract are made. Verify the location of all pertinent items. No additional compensation will be allowed for failure to be so informed.
- B. The Contractor shall submit a schedule indicating proposed sequence of operations for selective demolition Work to the General Contractor for review prior to commencing Work. Include coordination for shutoff, capping, and continuation of utility services as required, together with details for dust and noise control protection.
- C. Comply with regulatory requirements and notification regulations before beginning selective demolition.

D. Comply with hauling and disposal regulations of authorities having jurisdiction. A receipt indicating acceptance of hazardous wastes from a landfill facility licensed to accept such materials shall be submitted to the owner.

1.4 JOB CONDITIONS

A. Existing structures, utilities, drives, walks, etc., have been shown on the plans in their approximate location, others may exist and may be found upon visiting the site. It shall be the responsibility of the Contractor to accurately locate all facilities and to determine their extent. If such facilities obstruct the progress of the Work and are not indicated to be removed or relocated, they shall be removed or relocated only as directed by the Owner.

B. Owner assumes no responsibility for the actual condition of items or structures to be demolished.

C. Contractor shall investigate the possibility of existing septic tanks and drain fields near the location of existing foundations, prior to demolition. In the event that any possible septic tanks exist, this Contractor shall make further investigations, as necessary, to locate the septic tank and drain fields. Any septic tank and drain field found to exist shall be removed in accordance with the requirements of State and Local Health Departments.

D. Protect trees, plants, and natural features which are to remain as final landscaping.

E. Replace to new conditions any pavement or public right-of-way that is disturbed by the Work under this Section. All pavement replacement work in public rights-of-way shall be performed to the proper satisfaction of the governmental agencies having jurisdiction thereover.

- F. If cutting torches are used, take all necessary precautions to prevent setting of fires, including the use of fireproof tarpaulins and fire extinguishing apparatus adjacent to cutting area.
- G. Notify utility companies if removal or relocation of any existing utilities is required.
- H. Promptly repair damages caused to adjacent facilities by demolition Work.
- I. Do not close, block, or otherwise obstruct access to existing streets, sidewalks, driveways, and other adjacent occupied or used facilities during demolition. Any proposed closures shall have written permission from the authority having jurisdiction.
- J. Maintain existing utilities 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 demolition operations.
- K. Environmental Controls: Use water sprinkling, temporary enclosures, and other methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection.
 - 1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
- L. Underground Storage Tank Removal (if present): Contact all State, Federal and local agencies as may be required and determine the governing agencies requirements and provide agency contact information to the owner prior to construction.

1. Completely remove all tanks, equipment lines, foundations and surrounding soils. Keep owner informed as to the progress of the work and notify immediately of any irregularities.

1.5 DRAINAGE MAINTENANCE

- A. During the entire course of operations, all existing drainage ways, both into and from the Project area shall be maintained in a functional condition.
- B. At all times during the clearing operation, the exposed areas of subgrade shall be maintained in a condition compatible with positive drainage of the Work area. Failure to maintain such drainage shall be considered adequate cause for the Construction Manager to order temporary suspension of the Work.
- C. Cut drainage swales and provide temporary grading to carry storm water away from the demolition area. No water will be permitted to stand in open excavations.

PART 2 - PRODUCTS

- A. Use repair materials identical to existing materials. If identical materials are unavailable, use new materials whose performance is equal to or surpasses that of the existing material.
- B. Comply with material and installation requirements specified in the individual sections of this contract.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Locate, identify, and protect all known utilities which are to remain. If utilities are uncovered that are not shown on the plans, notify the owner and cease work in the immediate areas until instructed to how to proceed.

B. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structures to be demolished and adjacent facilities to remain.

1. Cease operations and notify the General Contractor, Architect and Owner immediately if safety of structure or adjacent structures appear to be endangered. Take precautions to support structure and **DO NOT** resume operations until a determination is made for continuing operations.

2. Provide bypass connections as necessary to maintain continuity of service to occupied areas of building.

C. Check with the water and sewer departments, Gas Company, and private utility companies to assure that all utilities and services are inoperative prior to their removal.

3.2 DEMOLITION

A. Perform 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. Sawcut asphalt pavement full depth at limits indicated for removal.

3. Concrete pavement shall be sawcut full depth and removed to the joint nearest the indicated removal limit or where specifically directed.

4. Where piping is to be bulkheaded, provide a permanent, water-tight plug consisting of brick and concrete mortar, one foot thick or prefabricated plugs intended for this purpose.

5. Maintain in operating conditions all active utilities, sewers and drains encountered.

6. The Contractor shall use extreme caution in removing any structures and utilities above and below grade to prevent damage to existing utilities which are to remain in service. Any existing utilities to remain, which are in any way damaged, shall be replaced at no additional cost to the Owner.

7. Conduct operations in such a manner as to minimize noise, dust and other disturbances.

3.3 DISPOSAL OF DEMOLISHED MATERIALS

A. Demolished material not indicated for turning over to the owner or specified for reuse, including rubble and other debris, shall become the property of the contractor and shall be removed daily from the project site and legally disposed of off the project site, at no expense to the Owner.

1. 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.

2. Burning of materials shall not be permitted on Site.

3.4 CLEANUP AND REPAIR

A. Upon completion of demolition Work, remove tools, equipment, and demolished materials from Site.

B. Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start of operations. Repair adjacent construction damaged by demolition Work.

END SECTION 02220

SECTION 02230 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
1. Protecting existing trees and vegetation to remain.
 2. Removing trees and other vegetation.
 3. Clearing and grubbing.
 4. Topsoil stripping.
 5. Removing above-grade site improvements.
- B. Related Sections include the following:
1. Section 02300 "Earthwork" for soil materials, excavating, backfilling, and site grading.
 2. Section 02480 "Landscape Work" for finish grading, including placing and preparing topsoil for lawns and planting
 3. Section 02530 "Sanitary Sewerage."
 4. Section 02630 "Storm Drainage."
 5. Section 02751 "Concrete Pavement"

1.3 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of weeds, roots, and other deleterious materials.

1.4 MATERIALS OWNERSHIP

- A. Except for materials indicated to be stockpiled or to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from the site.

1.5 SUBMITTALS

- A. Photographs, DVD or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

1.6 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct roads, walks, or other adjacent occupied or used facilities without permission from Owner.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Section 02300 "Earthwork."

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

- C. Locate and clearly flag trees and vegetation to remain.
- D. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TREE PROTECTION

- A. Erect and maintain a temporary fence around drip line of individual trees or around perimeter drip line of groups of trees to remain. Remove fence when construction is complete.
 - 1. Do not store construction materials, debris, or excavated material within drip line of remaining trees.
 - 2. Do not permit vehicles, equipment, or foot traffic within drip line of remaining trees.
- B. Do not excavate within drip line of trees, unless otherwise indicated.
- C. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

3.3 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain.
 - 2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.

3. Completely remove stumps, roots, obstructions, and debris extending to a depth of 18 inches below exposed Subgrade, unless noted otherwise.
 4. Use only hand methods for grubbing within drip line of remaining trees.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
1. Place fill material in horizontal layers not exceeding 8-inch loose depth, and compact each layer to a density equal to adjacent original ground.

3.4 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
1. Strip surface soil of unsuitable topsoil, including trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
1. Do not stockpile topsoil within drip line of remaining trees.

3.5 DISPOSAL

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 02230

SECTION 02300 - EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns, and plantings.
 2. Excavating and backfilling for buildings and structures.
 3. Proof-rolling subgrade.
 4. Granular fill course for slabs-on-grade.
 5. Base course for concrete walks and pavements.
 6. Excavating and backfilling trenches within building lines.
 7. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures is work of Divisions 15 and 16. This section sets forth the requirements of such work.
- B. Related Sections include the following:
1. Section 02230 "Site Clearing" for site stripping, grubbing, removing topsoil, and protecting trees to remain.
 2. Section 02480 "Landscape Work"
 3. Section 02530 "Sanitary Sewerage."
 4. Section 02630 "Storm Drainage."
 5. Section 02751 "Concrete Pavement."
 6. Division 15 and 16 Sections for excavating and backfilling buried mechanical and electrical utilities and buried utility structures.

1.3 DEFINITIONS

- A. Backfill: Soil materials used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Layer placed between the subgrade and asphalt or concrete paving.
- C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Compacted: Material at the required compaction or higher.
- F. Excavation: Removal of material encountered above subgrade elevations.
 - 1. Additional Excavation: Excavation below subgrade elevations as directed by Architect. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 - 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Maximum Density: The dry density at optimum moisture content in accordance with ASTM D1557 (Modified Proctor).
- I. Required Compaction: The ratio of in-place density to maximum density, expressed as a percentage.

- J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- L. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

- A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
 - 1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.
 - 2. Laboratory compaction curve according to ASTM D 1557 for each on-site or borrow soil material proposed for fill and backfill.

1.5 QUALITY ASSURANCE

- A. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.
 - 1. Comply with Michigan Department of Transportation (MDOT), 2012 Standard Specifications for Construction.
- B. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

1.6 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify the General Contractor and Owner not less than 72 hours in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without the General Contractor and Owner's written permission.
 3. Contact MISS DIG before excavating.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.
1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Backfill and Fill: Satisfactory soil materials.
- E. Base: Naturally or artificially graded mixture of natural or crushed gravel or crushed stone complying with MDOT Table 902-1 21AA Dense Graded Aggregate.
- F. Engineered Fill: Granular soil material complying with MDOT Table 902-1, Class II Granular Material.

- G. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- H. Granular Fill: Granular soil material complying with MDOT Table 902-1, Class II Granular Material.
- I. Pea Gravel: Clean, hard, durable, free flowing, naturally rounded particles of rock, free from clay lumps, with 100% passing a 3/8" sieve and not over 5% passing a #8 sieve.

2.2 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:
- B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water systems.
 - 5. Green: Sewer systems.
- C. Drainage Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
 - 1. Grab Tensile Strength: 110 lbf; ASTM D 4632.
 - 2. Tear Strength: 40 lbf; ASTM D 4533.
 - 3. Puncture Resistance: 50 lbf; ASTM D 4833.
 - 4. Water Flow Rate: 150 gpm per sq. ft.; ASTM D 4491.
 - 5. Apparent Opening Size: No. 50; ASTM D 4751.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- D. Subgrade is prone to disturbance during construction operations. Subgrade soils may also become disturbed due to ponding water and channeled construction traffic. Disturbed subgrade soils must be properly improved prior to floor slab and pavement construction or placement of engineered fill.

3.2 PROOF-ROLLING

- A. After stripping of topsoil and other surface organic matter and deleterious material and before further excavation, proof-roll entire building pad area to locate overly loose or soft areas and to compact the surface.
 - 1. Subgrade resulting from topsoil and organic material removal shall be thoroughly proof-rolled with fully loaded tandem-axle dump truck or other suitable piece of pneumatic-tired construction equipment. Proof-roll a minimum of ten passes in each of perpendicular direction.
- B. Areas of unsuitable subgrade shall be dried and recompacted in-place or remove and replaced with engineered fill.

- C. Special care shall be exercised when proofrolling adjacent to the existing building to minimize disturbance to existing footings and floor slabs.
 - 1. Use light proofrolling equipment for a strip approximately ten (10) feet wide along the existing building.
- D. Prior to concrete slab placement the prepared subgrade shall again be thoroughly proof-rolled. Disturbed areas shall be recompacted or removed and replaced with engineered fill.
- E. Proof-rolling operations must be done in presence of the Testing Agency.

3.3 DEWATERING

- A. Subgrade soils are prone to disturbance due to ponded water.
- B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 - 2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 - 2. Excavation for Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended for bearing surface.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
 - 1. Clearance: As indicated.
- C. Trench Bottoms: Excavate trenches a minimum of 4 inches deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.

3.8 EXCAVATION FOR SWALES

- A. Excavate swales to indicated gradients, lines, depths and elevations.
 - 1. Side slope of swales not to exceed 3H:1V.

3.9 APPROVAL OF SUBGRADE

- A. Notify Architect when excavations have reached required subgrade.
- B. If Architect determines based on the Testing Agency's recommendation that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
 - 1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect.

3.10 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Architect.
 - 1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.11 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.12 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including but not limited to perimeter insulation.
 - 2. Surveying locations of underground utilities for record documents.
 - 3. Inspecting and testing underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring and bracing, and sheeting.

3.13 UTILITY TRENCH BACKFILL

- A. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- B. Backfill trenches excavated under footings and within 18 inches of bottom of footings; fill with concrete to elevation of bottom of footings.
- C. Place and compact initial backfill of base course material, free of particles larger than 1 inch, to a height of 12 inches over the utility pipe or conduit.
 - 1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.
- D. Coordinate backfilling with utilities testing.
- E. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.
- F. Place and compact final backfill of satisfactory soil material to final subgrade.
- G. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.14 FILL

- A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.
- B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- C. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use granular fill or approved engineered fill as indicated on drawings.
 - 3. Under steps and ramps, use approved engineered fill.
 - 4. Under building slabs, use approved engineered fill.
 - 5. Under footings and foundations, use approved engineered fill.

3.15 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.16 COMPACTION OF BACKFILLS AND FILLS

- A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

- B. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill material at 95 percent.
 - 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 92 percent.
 - 3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 85 percent.

3.17 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. In general, the areas within the limits of buildings shall be rough graded to elevations 4" below bottom of slabs, filled with granular material as specified and finish graded to elevations at bottom of slabs.
 - 2. Provide a smooth transition between adjacent existing grades and new grades.
 - 3. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Lawn or Unpaved Areas: Plus or minus 1 inch.
 - 2. Walks: Plus or minus 1 inch.
 - 3. Pavements: Plus or minus 1/2 inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.18 BASE COURSES

- A. Under pavements and walks, place base course on prepared subgrade and as follows:
 - 1. Compact base courses at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
 - 2. Shape base to required crown elevations and cross-slope grades.
 - 3. When thickness of compacted base course is 6 inches or less, place materials in a single layer.
 - 4. When thickness of compacted base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

3.19 GRANULAR FILL COURSE

- A. Under slabs-on-grade, place granular fill course on prepared subgrade and as follows:
 - 1. Compact granular fill course to required cross sections and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.
 - 2. When compacted thickness of drainage course is 6 inches or less, place materials in a single layer.
 - 3. When compacted thickness of drainage course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

3.20 AGGREGATE FILL COURSE

- A. In areas below concrete or hot-mix asphalt pavements, place 21AA crushed limestone aggregate fill course on prepared subgrade and as follows:
 - 1. Compact aggregate fill course to required thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.
 - 2. Place materials equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

3.21 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At strip footing subgrades, at least one test each 10 feet o.c of each soil stratum will be performed to verify design bearing capacities.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 1000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
 - 2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for each 25 feet or less of wall length, but no fewer than two tests.
 - 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 50 feet or less of trench length, but no fewer than two tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.22 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.23 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 02300

SECTION 02370 - SOIL EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Sedimentation Control Fencing
- B. Catch Basin / Inlet Protection
- C. Temporary and Permanent Sedimentation Control Measures

1.2 REGULATORY REQUIREMENTS

- A. Work under this Section includes all work necessary for effective soil erosion and sedimentation control in conformance with Part 91, Act 451, PA 1994, the Soil Erosion and Sedimentation Control Act.
- B. Rules, regulations or laws of any controlling governmental agency shall govern, when they are more stringent than the requirements of this Section.
- C. All earth changes shall be made in such a manner as to minimize the area of disturbed land exposed and unprotected against erosion and the duration of such exposure.
- D. Sediment caused by accelerated soil erosion shall be restricted to a non-polluting minimum (as determined by the agency designated in accordance with, and having jurisdiction and responsibility for the enforcement of sedimentation control).
- E. All sedimentation control measures shall be maintained in an operating condition satisfactory to the designated agency, for the period of time, which that agency deems necessary. This provision applies to all facilities that directly receive waters from the earth-change area, whether such facilities are a part of the proposed construction or existed prior to proposed construction.
- F. Temporary stabilization measures shall be repeated when, and as often as, required by the aforementioned agency.

G. Any facility constructed for the conveyance of water around, through or from the earth-change area shall limit the water flow to a non-erosive velocity.

H. Temporary sedimentation control devices and facilities shall be removed upon completion of the primary construction. The land surface area formerly occupied by such facilities shall then be graded and restored in accordance with the Plans and Specifications.

1.3 PERMITS

A. Obtain all pertinent permits including a Soil Erosion Control Permit from the MDEQ, county or local governing agency having jurisdiction of the Erosion Control.

B. Submit an NPDES Notice of Coverage, if required, when the soil erosion permit is received.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Straw bales and mulch shall be clean wheat straw or marsh hay. Straw shall be clean and free of weeds and weed seed. Hay will be allowed only when straw is not available. Bales are to be standard rectangular shape held together with 2 strands of hemp rope.

B. Sediment control / silt fence shall be a geotextile filter fabric capable of containing sediment, attached to wooden stakes capable of supporting the geotextile fabric.

C. Acceptable geotextile catch basin filter wrap

PART 3 - EXECUTION

3.1 CONSTRUCTION SEQUENCE

A. To minimize the area of unstabilized land surface over which storm waters must flow, construction shall proceed from lower ground toward higher ground whenever possible.

3.2 TEMPORARY STOCKPILES

- A. The Site Contractor shall take steps to prevent, or contain on-site, erosion from material stockpiles.

3.3 SEDIMENTATION CONTROL

- A. The Site Contractor shall provide a suitable temporary sedimentation control facility at any connection to an existing enclosed storm drain, to minimize deposition of sediment in the existing storm drain during construction.
- B. To prevent sediment from entering existing storm drains during the construction period, the Site Contractor shall provide suitable control facilities around storm water inlet facilities.
- C. All open ditches and natural watercourses intercepted by the proposed construction shall be temporarily re-routed, provided with temporary sedimentation control facilities within their cross-section, and/or diverted into a newly-established drain via non-erosive channels.
- D. Temporary sedimentation control devices and/or facilities shall be as designated on the Plans. Modifications to the Plan requires prior approval of the Engineer and local permitting agency.
- E. In all cases, such facilities, whether permanent or temporary, shall be provided prior to any significant clearing, grading or surface disruption of the tributary area.

3.4 DE-WATERING

- A. Pumped water from well points or de-watering wells installed to lower the water table to facilitate the proposed construction shall not discharge onto unstabilized areas. Such discharge shall be conveyed by pipe, hose or stabilized channel to a settling basin or other suitable sedimentation control facility.

3.5 WATERCOURSE PROXIMITY

A. Where natural streams, marshes or existing drainage watercourses are encountered within, or are situated within 500' of the proposed construction, special care shall be exercised to minimize erosive losses and water contamination. These shall include, but not be limited to, the following:

1. Prompt completion of Work (including clean-up operations) in all areas adjacent to streams, marshes or watercourses.
2. Use of temporary or permanent erosion control devices during construction to minimize erosion and the resultant deposition of sediment into any stream, marsh or watercourse.

3.6 VEHICULAR CONTROLS

A. Where vehicles or heavy equipment must cross streams, ditches or other existing watercourses, installation of culverts or bridges at approved locations will generally be required. Where frequent use of improved roads by off-the-road vehicles is encountered, suitable cleaning methods shall be used to minimize the transfer of sediment-producing materials from the wheels of the vehicles onto the improved surface. Site Contractor shall keep adjacent roads free of debris.

3.7 RESTABILIZATION OF TERRAIN

A. Final cleanup shall leave the property in equal or better condition than it was at the beginning of construction. Cleanup operations including at least rough grading and temporary stabilization shall be started as soon as feasibly possible where:

1. Pipe is laid in any location
2. One acre or more of the ground surface is brought to its approximate proposed elevation, in an earth excavation, mining, landfilling, mass grading, or land balancing project.

3. Substantial completion of the base, the curb, or the curb and gutter, whichever first occurs, in a road, street, highway, parking area or sidewalk construction project; and shall be completed within the next fifteen (15) days.
- B. Temporary stabilization applied during freezing weather shall consist of hay or straw mulch applied at the rate of 2 tons per acre, "tacked" in place by locally approved methods. Temporary stabilization applied during other than freezing weather shall consist of perennial rye grass applied at the rate of 25 pounds per acre with hay or straw mulch applied at the rate of 2 tons per acre, "tacked" in place with locally approved methods.
- C. Temporary stabilization shall be provided during the non-growing season for all areas to be seeded / sodded. This time period is generally from October 15 through April 15, both inclusive.
- D. Temporary stabilization shall be provided for all uncompleted areas where significant earth disruption ceases for more than 30 days.
- E. All areas which have been temporarily stabilized shall be permanently stabilized no later than 30 days following commencement of the planting season immediately following substantial completion of construction.
- F. All mulch used for temporary stabilization shall be removed prior to permanent stabilization.
- G. Permanent Stabilization is hereby defined as the Work described elsewhere in the Specifications under Section 02480 "Landscape Work".

3.8 SITE CONTRACTOR'S GENERAL RESPONSIBILITY

- A. The Site Contractor shall be responsible for the proper implementation of the "Soil Erosion and Sedimentation Control Plan" as a part of this Contract, unless noted otherwise. If a Soil Erosion and Sedimentation Control plan is supplied in the project drawings, the Site Contractor shall install the proposed Soil Erosion and Sedimentation Control measures per the plan. It is the responsibility of the Site Contractor to meet all local and

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state ordinances. A regular inspection program and a thorough maintenance program shall be developed and implemented by the Contractor to insure the effectiveness of the erosion and sedimentation control practices.

END OF SECTION 02370

SECTION 02411 - FOUNDATION DRAINAGE SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 DESCRIPTION OF WORK:

- A. The extent of foundation drainage system work is shown on the drawings.
- B. Related Work Specified Elsewhere:
 - 1. Connecting foundation drainage: Division 15.
 - 2. Drainage fill course under slabs on grade: Section 02620.

1.3 QUALITY ASSURANCE:

- A. Codes and Standards:
 - 1. Perform foundation drainage work in compliance with applicable requirements of governing authorities having jurisdiction.

1.4 SUBMITTALS:

- A. Certification:
 - 1. Submit two (2) copies of Certification signed by the foundation drainage system installer that installed materials conform to specified requirements and system was successfully checked and tested prior to covering with filtering and drainage fill.

PART 2 - PRODUCTS

2.01 DRAINAGE PIPE AND FITTINGS:

- A. Furnish drainage pipe complete with bends, reducers, adapters, couplings, collars and joint materials.
- B. Porous Concrete Pipe: ASTM C 654, "Standard-Strength"

unless otherwise indicated.

2.02 SOIL MATERIALS:

- A. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense composite.
- B. Drainage Fill: Uniformly graded mixture of natural or crushed gravel, crushed stone, and natural sand with 100% passing a 1-1/2'' sieve and 0-5% passing a No. 50 sieve.
- C. Filtering Material: Uniformly graded mixture of natural or crushed gravel, crushed stone, and natural sand, with 100% passing a 1/2'' sieve and 0-5% passing a No. 50 sieve.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Examine the areas and conditions under which foundation drainage system is to be installed and notify the General Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

3.02 INSTALLATION:

- A. Impervious Fill:
 - 1. Place impervious fill material on the subgrade under drainage system. Place and compact impervious fill 6'' deep and 12'' wide.
- B. Filtering Material:
 - 1. Place a supporting layer of filtering material over compacted subgrade where drainage pipe is to be laid to a compacted depth of not less than 4''.
 - 2. After testing of drain lines, place additional filtering material to a 4'' depth around sides and top of drains.
- C. Laying Drain Pipe:
 - 1. Lay drain pipe solidly bedded in filtering material. Provide full bearing for each pipe section throughout its length, to true grades and alignment, and continuous slope in the direction of flow.

D. Testing Drain Lines:

1. Test or check lines before backfilling to assure free flow. Remove obstructions, replace damaged components and retest system until satisfactory.

E. Drainage Fill:

1. Place drainage fill over drain lines after satisfactory testing and covering of drain lines with filtering material. Completely cover drain lines to a width of at least 6'' on each side and 12'' above top of pipe, unless more coverage is indicated on the drawings. Place fill material in layers not exceeding 3'' in loose depth and compact each layer placed.
 - a. Overlay drainage fill material with one layer of 15-lb. asphalt or tar-saturated felt overlapping edges at least 4''.

END OF SECTION 02411

SECTION 02480 - LANDSCAPE WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

- A. The extent of the landscape development work is shown on the drawings and in schedules.
- B. Sub-grade Elevations: Elevation, filling and grading required to establish elevations shown on the drawings are not specified in this Section. Refer to Section 02300, Earthwork.

1.03 QUALITY ASSURANCE:

- A. Subcontract the landscape work to a single firm specializing in landscape work.
- B. Source Quality Control:
 - 1. General: Ship landscape materials with certificates of inspection as required by governmental authorities. Comply with governing regulations applicable to landscape materials.
 - 2. Do not make substitutions. If specified landscape material is not obtainable, submit to Architect proof of non-availability and proposal for use of equivalent material. When authorized, adjustment of contract amount will be made.
 - 3. Analysis and Standards: Package standard products with manufacturer's certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agricultural Chemists, wherever applicable or as further specified.
 - 4. Trees: Provide trees grown in a recognized nursery in accordance with good horticultural practice. Provide healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, or disfigurement.

- a. Sizes: Provide trees of the sizes shown or specified. Trees of larger size may be used if acceptable to the Architect, and if sizes of roots or balls are increased proportionately.
 5. Inspection: Architect reserves the right to inspect trees either at place of growth, or at site before planting for compliance with requirements for names, variety, size, and quality.
- 1.04 SUBMITTALS:
- A. Certification:
 1. Submit two (2) copies of certificates of inspection as required by governmental authorities, and manufacturer's or vendors certified analysis for soil amendments and fertilizer materials. Submit other data substantiating that materials comply with specified requirements.
 - B. Planting Schedule:
 1. Submit three (3) copies of planting schedule showing scheduled dates for each type of planting in each area of site.
 - C. Maintenance Instructions:
 1. Submit two (2) copies of typewritten instructions recommending procedures to be established by the Owner for the maintenance of landscape work for one (1) full year. Submit prior to expiration of required maintenance period(s).
- 1.05 PRODUCT DELIVERY, STORAGE AND HANDLING:
- A. Packaged Materials:
 1. Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored at the site.
 - B. Plant Materials:
 1. Sod: Time delivery so that sod will be placed within 24 hours after stripping. Protect sod against drying and breaking of rolled strips.

2. Trees: Provide freshly dug trees. Do not use trees which have been in cold storage or heeled-in. Do not prune prior to delivery. Do not bend or bind-tie trees in such manner as to damage bark, break branches, or destroy natural shape. Provide protective covering during delivery.
3. Dig Balled and Burlapped (BB) plants with firm, natural balls of earth of diameter not less than that specified, and of sufficient depth to include all the fibrous feeding roots. No plant moved with a ball will be accepted if the ball is cracked or broken before or during planting operations, except on special approval.
4. Deliver trees after preparations for planting have been completed and plant immediately. If planting is delayed more than six (6) hours after delivery, set trees in shade, protect from weather and mechanical damage, and keep roots moist.
5. Do not remove container grown stock from containers until planting time.
6. Label at least one (1) tree of each variety with a securely attached waterproof tag bearing legible designation of botanical and common name.

1.06 JOB CONDITIONS:

- A. Proceed with and complete the landscape work as rapidly as seasonal limitations for each kind of landscape work required.
- B. Utilities: Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required, to minimize possibility of damage to underground utilities. Maintain grade stakes set by others until removal is mutually agreed upon by all parties concerned.
- C. Excavation: When conditions detrimental to plant growth are encountered such as rubble fill, adverse drainage conditions, or obstructions, notify Architect before planting.
- D. Planting Schedules: Prepare a proposed planting schedule. Schedule the dates for each type of landscape work during the normal seasons for such work in the area of the site. Correlate with specified maintenance periods to provide

maintenance until occupancy by the Owner. Once accepted, revise dates only as approved in writing, after documentation of reasons for delays.

- E. Coordination with Lawns: Plant trees after final grades are established and prior to planting of lawns, unless otherwise acceptable to the Architect. If planting of trees occurs after lawn work, protect lawn areas and promptly repair damage to lawns resulting from planting operations.

1.07 WARRANTY:

- A. Warranty lawns through the specified maintenance period, and until final acceptance.
- B. Warranty trees for a period of one (1) year after date of acceptance against defects, including death and unsatisfactory growth, except for defects resulting from neglect by Owner, abuse or damage by others, or unusual phenomena or incidents which are beyond Landscape Installer's control.
- C. Remove and replace trees or other plants found to be dead or in unhealthy condition during warranty period. Plant missing trees and plants. Make replacements during growth season following end of warranty period. Furnish and plant replacements which comply with requirements shown and specified. Also, replace trees which are in doubtful condition at end of warranty period; unless, in the opinion of the Architect, it is advisable to extend warranty period for a full-growing season. The Architect will make another inspection at the end of extended warranty period, if any, to determine acceptance or rejection. Only one replacement will be required at end of warranty period, except for losses or replacement due to failure to comply with specified requirements.

PART 2 - PRODUCTS

2.01 TOPSOIL:

- A. Provide new topsoil which is fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds, and other litter, and free of roots, stumps, stones larger than 2" in any dimension, and other extraneous or toxic matter harmful to plant growth.
 - 1. Provide all new topsoil; do not use any on site.

2.02 SOIL AMENDMENTS:

- A. Lime: Natural limestone containing not less than 85% of total carbonates, ground so that not less than 90% passes a 10-mesh sieve, and not less than 50% passes a 100-mesh sieve.
- B. Peat Humus: FS Q-P-166 and with the texture and ph range suitable for the intended use.
- C. Bonemeal: Commercial, raw, finely ground, 4% nitrogen and 20% phosphoric acid.
- D. Superphosphate: Soluble mixture of treated minerals; 20% available phosphoric acid.
- E. Commercial Fertilizer: Complete fertilizer of neutral character with some elements derived from organic sources and containing the following percentages of available plant nutrients:
 - 1. For trees, provide fertilizer with not less than 10% available phosphoric acid and from 3% to 5% total nitrogen, and from 3% to 5% soluble potash.
 - 2. For lawns, provide fertilizer with not less than 4% phosphoric acid and not less than 2% potassium, and the percentage of nitrogen required to provide not less than 1 lb. of actual nitrogen per 1000 sq.ft. of lawn area. Provide nitrogen in a form that will be available to the lawn during the initial period of growth.

2.03 PLANT MATERIALS:

- A. Name and Variety: Provide plant materials true to name and variety established by the American Joint Committee on Horticultural Nomenclature "Standardized Plant Names" Second Edition, 1942. Substitutions or indigenous local specie may be proposed if still deciduous or evergreen as required. Substitutions must be same size or larger. Comply with all other requirements acceptable to the Architect.
- B. Quality: Provide trees and other plants complying with the recommendations and requirements of ANSI 760; "Standard for Nursery Stock" and as further specified.

- C. Measurements: Measure all trees when their branches are in normal position. Height and spread dimensions indicated refer to the main body of the plant, not from branch or root tip to tip. Determine caliper as follows:
 - 1. For 4" and smaller, measure diameter of trunk 6" above grade.
 - 2. For larger than 4", measure diameter of trunk 12" above grade.
- D. Do not cut leaders or otherwise damage by unnecessary cutting.
- E. Deciduous Trees: Provide trees of height and caliper listed or shown and with branching configuration recommended by ANSI Z60.1 for type and species required. Provide single stem trees except where special forms are shown or listed. Ball and burlap (BB) deciduous trees.

2.04 GRASS MATERIALS:

- A. Sod: Provide strongly rooted sod not less than two (2) years old and free of weeds and undesirable native grasses. Provide only sod capable of growth and development when planted (viable, not dormant) and in strips not more than 18" long. Provide sod composed principally of Kentucky Bluegrass (*Poa Pratensis*) or its equivalent, as acceptable to the Architect.

2.05 SEED:

- A. Seed shall be a mixture composed of the following:

Seeding shall be specified as one of these two mixtures:

Improved Kentucky Bluegrass Mixture

Touchdown Kentucky	
Bluegrass	6#/1000 Sq. Ft.

Barron Kentucky	
Bluegrass	6#/1000 Sq. Ft.

Grass shall be fresh, new crop seed. The Contractor shall furnish the Owner the dealer's guaranteed statement of the composition of the mixture and the percentages of purity and germination and a copy of the State Certification for the seed.

B. Hydro-Seed Option:

The Contractor is advised that he may use hydro-seeding or hydro-mulching operations in lieu of mechanical seeding if he so desires.

2.06 MISCELLANEOUS LANDSCAPE MATERIALS:

- A. Anti-Desiccant: Emulsion type, film-forming agent similar to Dowax by Dow Chemical Co. or Wilt-Prof by Nursery Specialty Products, Inc., designed to permit transpiration but retard excessive loss of moisture from plants. Deliver in manufacturer's fully identified containers and mix in accordance with manufacturer's instructions.
- B. Wrapping: Tree-wrap tape not less than 4" wide, designed to prevent bore damage and winter freezing fabricated from bituminous lined two-ply paper.
- C. Stakes and Guys: Provide stakes and deadmen of sound new hardwood, treated softwood, or redwood, free of knot holes and other defects. Provide wire ties and guys of 2-strand, twisted, pliable galvanized iron wire not lighter than 12 USWG with zinc-coated turnbuckles. Provide net 2-ply fabric black rubber hose not less than 1/2" hose size, cut to required lengths to protect tree trunks from damage by wires.
- D. Plastic Sheet: Black, weather resistant polyethylene sheeting complying with FS L-P-512, Type III, 0.008" (6 mils) thick.
- E. Mulch: For uses other than with hydro-seeding, operations shall be hay or straw, not chopped in short lengths. Mulch used with hydro-seeking operations shall be a wood cellulose fiber containing no growth or germination inhibiting factors. Rate of application for wood cellulose fiber mulch in hydro-seeking operations shall be 1500 pounds per acre, or 35 pounds per 1000 square feet.

2.07 PREPARATION OF PLANTING SOIL:

- A. Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth.
- B. Mix specified soil amendments and fertilizers with topsoil as provided herein. Delay mixing of fertilizer if planting will not follow placing of planting soil within a few days. Prepare mix on site using four parts topsoil to

one part peat, and add 5 lbs. super phosphate to each cubic yard. Completely mix mechanically and add fertilizer as directed by the Architect.

- C. For pit type back fill, mix planting soil prior to back filling and stockpile at the site.
- D. For planting beds, mix planting soil either prior to planting or apply on surface of topsoil and mix thoroughly before planting.
 - 1. Mix lime with dry soil prior to mixing of fertilizer.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Installer must examine the subgrade, verify the elevations, observe the conditions under which work is to be performed, and notify the General Contractor of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 PREPARATION:

- A. Layout individual tree locations and areas for multiple plantings. Stake locations and outline areas and secure Architect's acceptance before start of planting work. Make minor adjustments as may be requested.
- B. Preparation for Planting Lawns:
 - 1. Loosen subgrade of lawn areas to minimum depth of 4". Remove stones over 1-1/2" in any dimension, and sticks, roots, rubbish, and other extraneous matter. Limit preparation to areas which will be planted promptly after preparation.
 - 2. Spread topsoil to minimum depth required to meet lines, grades, and elevations shown, but not less than 4" after light rolling and natural settlement.
 - 3. Place approximately 1/2 of total amount of topsoil required. Work into top of loosened subgrade to create a transition layer and then place remainder of topsoil.
 - 4. Allow for sod thickness in areas to be sodded.

5. Grade lawn areas to smooth, even surface with loose, uniformly fine texture. Roll and rake and remove ridges and fill depressions as required to meet finish grades. Limit fine grading to areas which can be planted immediately after grading.
6. Apply fertilizer by mechanical spreading at a rate of not less than 20 lbs. per 1,000 sq. ft.. Blend with top 1" of soil.
7. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create a muddy soil condition.
8. Restore lawn areas to specified condition if eroded or otherwise disturbed after fine grading and prior to planting.
9. Preparation of Unchanged Grades: Where lawns are to be planted in areas that have not been altered or disturbed by excavating, grading, or stripping operations, prepare soil for lawn planting as follows:

Till to a depth of not less than 6"; apply soil amendments and initial fertilizers as specified; remove high areas and fill in depressions; till soil to a homogenous mixture of fine texture, free of lumps, clods, stones, roots, and other extraneous matter.
 - a. Prior to preparation of unchanged areas, remove existing grass, vegetation and turf. Dispose of such material outside of Owner's property; do not turn over into soil being prepared for lawns.

C. Preparation of Planting Beds:

1. Loosen subgrade of planting bed areas to a minimum depth of 6" using a cultimulcher or similar equipment. Remove stones over 1-1/2" in any dimension, and sticks, stones, rubbish, and other extraneous matter.
2. Spread planting soil mixture to minimum depth required to meet lines, grades and elevations shown after light rolling and natural settlement. Place approximately 1/2 of total amount of planting soil required. Work into top of loosened subgrade to create a transition layer, then place remainder of the planting soil.

D. Excavation for Trees:

1. Excavate pits, beds and trenches with vertical sides and with bottom of excavation slightly raised at center to provide proper drainage. Loosen hard subsoil in bottom of excavation.
2. For balled and burlapped, (BB) trees, make excavations at least twice as wide as the ball diameter and equal to the ball depth, plus the following allowance for setting of ball on a layer of compacted back fill. Allow for 4" setting layer of planting soil mixture.
3. Dispose of subsoil removed from landscape excavations. Do not mix with planting soil or use as back fill.
4. Fill excavations for trees with water and allow to percolate out before planting.

3.03 PLANTING:

A. Planting Trees:

1. Set balled and burlapped (BB) stock on layer of compacted planting soil mixture, plumb and in center of pit or trench with top of ball at same elevation as adjacent finished landscape grades. Remove burlap from sides of balls; retain on bottoms. When set, place additional soil mixture back fill around base and sides of ball, and work each layer to settle back fill and eliminate voids and air pockets. When excavation is approximately 2/3 full, water thoroughly before placing remainder of back fill. Repeat watering until no more is absorbed. Water again after placing final layer of back fill.
2. Dish top of back fill to allow for mulching.
 - a. For spring planting, provide additional back fill berm around edge of excavations to form shallow saucer to collect water.
3. Mulch pits, trenches, and planted areas. Provide not less than 4" and finish level with adjacent finish grades using shredded bark.
4. Apply anti-desiccant using power spray to provide an adequate film over trunks, branches, stems, twigs, and foliage.

- a. If deciduous trees are moved in full-leaf, spray with anti desiccant at nursery before moving and again two (2) weeks after planting.
 5. Prune, thin out and shape trees in accordance with standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise directed by the Architect, do not cut tree leaders, and remove only injured or dead branches from flowering trees, if any.
 6. Remove and replace excessively pruned or misformed stock resulting from improper pruning.
 7. Paint cuts over 1/2" in size with standard tree paint or compound covering exposed, living tissue. Use paint which is waterproof, antiseptic, adhesive, elastic, and free of kerosene, coal tar, creosote, and other substances harmful to plants. Do not use shellac.
 8. Wrap trunks of all deciduous trees taller than 8'. Start at ground and cover trunk to height of second limbs and secure at every second wrap.
 9. Inspect tree trunks for injury, improper pruning, and insect infestation, and take corrective measures required before wrapping.
 10. Guy and stake trees immediately after planting as follows:
 - a. Guy three (3) ways securing wire to 2" x 4" x 30" stakes set two (2) feet in the ground.
- B. Sodding New Lawns:
1. Lay sod within 24 hours from time of stripping. Do not plant dormant sod or if ground is frozen.
 2. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips; do not overlap. Stagger strips to offset joints in adjacent courses. Work from boards to avoid damage to subgrade or sod. Tamp or roll lightly to ensure contact with subgrade. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering of adjacent grass.

3. Secure sod on slopes with wood pegs to prevent slippage.
4. Water sod thoroughly with a fine spray immediately after planting.

C. Mechanical Seeding:

1. Seeding: The Contractor shall seed all areas with grass seed as specified, sowing evenly with an approved mechanical seeder at the rate specified in 2.05A. Sow one-half the seed in one direction and the other half at right angles to the first seeding. To cover the seed and firm the soil, the seed bed shall then be lightly rolled with a cultipacker. In areas inaccessible to the cultipacker, the seeded ground shall be lightly raked and rolled in two directions with water ballast roller. Extreme care shall be taken during seeking and raking to insure that no change shall occur in the finished grades and that the seed is not raked from one spot to another. If the areas are seeded by a large mechanical seeder which works the seed into the soil and at the same time rolls the seed bed, it is not necessary to roll the seed bed separately.
2. Mulching: After sowing, mulch shall be spread evenly at the rate of 2 tons per acre over newly seeded areas. The mulch shall be applied in a uniform layer, loose enough to allow sunlight to penetrate and air to circulate, yet sufficient to shade the soil and reduce erosion. The mulch shall be held in place by crimping, cultipacking, spraying with asphalt emulsion, or any other means satisfactory with the Owner.

D. Hydraulic Seeding (option):

1. The Contractor shall seed with hydraulic seeding equipment, using fertilizer and mulch of the type and at the rate previously specified. Slurry shall be distributed uniformly over the area at the designated application rate. areas inaccessible to such equipment may be fertilized and seeded by hand.

3.04 MISCELLANEOUS LANDSCAPE WORK:

- A. Place wood chip mulch beds where shown. Compact soil sub grades and lay 6 mil carbonated polyethylene film over compacted subgrade prior to placing mulch.

3.05 MAINTENANCE:

- A. Begin maintenance immediately after planting.
- B. Maintain trees and other plants until final acceptance, but in no case less than 30 days after planting.
- C. Maintain trees and other plants by pruning, cultivating, and weeding as required for healthy growth. Restore planting saucers. Tighten and repair stake and guy supports, and reset trees to proper grades or vertical position as required. Restore or replace damaged wrapping. Spray as required to keep trees free of insects and disease. Feed trees as specified and as may be required.
- D. Feeding Program:
 - 1. Feed all trees at least one time prior to final acceptance. Schedule feeding as follows:
 - a. For Spring and early Summer planting, feed shortly after installation.
 - b. For late Summer and Fall planting, feed the following Spring.
 - 2. Rake back mulch, apply fertilizer, and replace mulch. Fertilize with 10-6-4 analysis fertilizer, applying uniformly over cultivated ground area surrounding each plant. Apply fertilizer at the following rates:
 - a. Shade trees - 2 lbs. per inch or caliper.
 - b. Small trees - 1 lb. per inch of caliper.
- E. Maintain lawns as indicated in Section 02499 "Landscape Maintenance and Warranty Standards".
 - 1. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading and replanting as required to establish a smooth, acceptable lawn free of eroded or bare areas.

3.06 CLEAN UP AND PROTECTION:

- A. During landscape work, store materials and equipment where directed. Keep pavements clean and work area in an orderly condition.

- B. Protect landscape work and materials from damage due to landscape operations, operations by other contractors, trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

3.07 INSPECTION AND ACCEPTANCE:

- A. When the landscape work is completed including maintenance, the Architect will, upon request, make an inspection to determine acceptability.
- B. Where inspected landscape work does not comply with the requirements, replace rejected work and continue specified maintenance until reinspected by the Architect and found to be acceptable. Remove rejected plants and materials promptly from the project site.

END OF SECTION 02480

SECTION 02484 - TOPSOIL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Bidding and Contract Requirements, General and Supplemental Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

- A. Extent of Topsoil Work is shown on drawings and by provisions of this section.
- B. Topsoil for lawn work shall be as stripped from site or provided by the Contractor from off-site sources at no extra cost to the Owner.
- C. Related Work Specified Elsewhere:

- 1. Section 02300: Earthwork

1.03 QUALITY ASSURANCE:

- A. Testing and Inspection: For supplied and stockpiled topsoil only. Performed by a qualified independent testing laboratory, under the supervision of a registered professional engineer, specializing in soils engineering.
- B. Provide and pay for testing and inspection during topsoil operations. Laboratory, inspection services and Soil Engineer shall be acceptable to the Landscape Architect.

- 1. Recommended testing laboratory:
A & L Agricultural Laboratories, Inc.
3505 Conestoga Drive
Fort Wayne, IN 46808
(219) 483-4759

- C. Test representative material samples for proposed use.
- D. Topsoil: (Supplied and stockpiled)
 - 1. pH factor
 - 2. Mechanical analysis
 - 3. Percentage of organic content

- E. Recommendations on type and quantity of additives required to establish satisfactory pH factor and supply of nutrients to bring nutrients to satisfactory level for planting.
- F. Submit test reports.
- G. Topsoil: Existing on site from stockpile - proposed for use.

1.04 PROJECT CONDITIONS:

- A. Known underground and surface utility lines are indicated on the drawings.
- B. Protect existing trees, plants, lawns and other features designated to remain as part of the landscaping work.
- C. Promptly repair damage to adjacent facilities caused by topsoil operations. Cost of repair at Contractor's expense.
- D. Promptly notify the Landscape Architect of unexpected sub-surface conditions.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Topsoil: Supplied and stockpiled topsoil proposed for use must meet testing criteria results specified and conform to adjustments as recommended by soil test and Landscape Architect.
- B. Existing topsoil: Existing topsoil from on stockpile shall be utilized. All processing, cleaning and preparation of this stored topsoil to rend it acceptable for use is the responsibility of the Contractor.
- C. Provide additional topsoil as required to complete job at unit cost. Topsoil must meet testing criteria results specified. All processing, cleaning nad preparation of this stored topsoil to render it acceptable for use is the responsibility of this Contractor.

- D. Supplied and stockpiled topsoil, shall be fertile, friable and representative of local productive soil, capable of sustaining vigorous plant growth and free of clay lumps, subsoil, noxious weeds or other foreign matter such as stones, roots, sticks and other extraneous materials: not frozen or muddy. Ph of soil to range between 5.0 and 7.5.
- E. Crowning/mounding to be free flowing in shape and design, and to blend into existing grades gradually.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Examine rough grades and installation conditions. Do not start topsoil work until unsatisfactory conditions are corrected.

3.02 FINISH GRADING:

- A. Perform topsoiling within contract limits, including adjacent transition areas, to new elevations, levels, profiles, and contours indicated. Provide uniform levels and slopes between new elevations and existing grades.
- B. Grade surfaces to assure areas drain away from building structures and to prevent ponding and pockets of surface drainage.
- C. Lawn and planting areas: Supply and spread topsoil to 4" minimum compacted depth in lawn areas or as indicated on drawings.
- D. Regardless of finish grading elevations indicated, it is intended that grading be such that proper drainage of surface water will occur and that no low areas created to allow ponding. Contractor to consult with Owner or Landscape Architect regarding minor variations in grade elevations before rough grading is completed.

3.03 CLEANING:

- A. Upon completion of earthwork operations, clean areas within contract limits, remove tools and equipment. Site shall be clear, clean, free of debris and suitable for site work operations.

END OF SECTION 02484

SECTION 02499 - LANDSCAPE MAINTENANCE AND WARRANTY STANDARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Bidding and Contract Requirements, and to General and Supplemental Conditions, hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

- A. The requirements of this Section include a one year warranty period from date of acceptance of installation.
- B. Related Work Specified Elsewhere:
 - 1. Section 02480: Landscape Work

1.03 ACCEPTANCE OF INSTALLATION:

- A. At the completion of all landscape installation, or pre-approved portions thereof, the Landscape Contractor shall request in writing an inspection for acceptance of installation in which the Landscape Contractor, Landscape Architect and Owner's Representative shall be present. After this inspection a "Punch List" will be issued by the Landscape Architect and/or Owner's Representative shall re-inspect the project and issue a written statement of acceptance of installation and establish the beginning of the project warranty period.
- B. Landscape work may be inspected for acceptance in parts agreeable to Owner's Representative and Landscape Architect provided work offered for inspection is complete, including maintenance as required.
- C. For work to be inspected for partial acceptance, Contractor shall provide a drawing outlining work completed, and supply a written statement requesting acceptance of this work completed to date.

1.04 PROJECT WARRANTY:

- A. The project warranty period begins upon written acceptance of the project installation by Landscape Architect and Owner's Representative.

- B. The Landscape Contractor shall guarantee seeded areas through construction and for a period of one year after date of acceptance of installation against defects including death and unsatisfactory growth, except for defects resulting from neglect by Owner, abuse or damage by others, or unusual phenomena or incidents which are beyond Landscape Contractor's control.

1.05 MAINTENANCE:

- A. To insure guarantee standards, the following maintenance procedures shall be executed during construction and for the full project warranty period.
- B. Maintenance of Seeded Lawn Areas:
 - 1. The Contractor shall establish a dense lawn of permanent grasses, free from lumps and depressions or any bare spots, none of which is larger than one foot of area up to a maximum of 3% of the total seeded lawn area. Any part of the seeded lawn that fails to show a uniform growth and/or germination shall be reseeded until a dense cover is established.
 - 2. If seeded in fall or if not considered acceptable at that time, continue maintenance the following spring until acceptable lawn is established.
 - 3. The Contractor shall provide a minimum of two cuttings of the lawn or more as necessary until the inspection and acceptance of installation by the Owner's Representative and Landscape Architect. When the lawn reaches 3 inches in height it shall be cut to 2 inches in height. When meadow lawn reaches 6" in height it shall be cut to 4" in height.
 - 4. The Owner assumes cutting responsibilities following the acceptance of installation by the Owner's Representative and the Landscape Architect.
 - 5. After acceptance of installation, and for the duration of the project warranty period the Landscape Contractor shall continue all other maintenance procedures including fertilizing and weeding, and other operations such as rolling, regrading, replanting, and applying herbicides, fungicides, insecticides as required to establish a smooth, acceptable lawn free of eroded or bare areas.

6. Repair, rework, and reseed all areas that have washed out, and eroded, or do not substantially germinate.
7. At conclusion of project warranty period and after receiving written final acceptance by Owner's Representative and Landscape Architect, the Owner shall assume all seeded lawn maintenance responsibilities.

1.06 FINAL ACCEPTANCE:

- A. At the conclusion of the project warranty period the Landscape Contractor shall request a project inspection for final acceptance in which the Landscape Contractor, Landscape Architect and Owner's Representative shall be present. After this inspection a "Punch List" will be issued by the Landscape Architect. Upon completion of all punch list items, the Landscape Architect and Owner's Representative shall reinspect the project and issue a written statement of final acceptance. Upon final acceptance the Owner assumes all maintenance responsibilities for the landscape of the project.

PART 2 AND 3 - PRODUCTS AND EXECUTION

Not Applicable.

END OF SECTION 02499

SECTION 02530 - SANITARY SEWERAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes sanitary sewerage outside the building.
- B. Related Sections include the following:
 - 1. Section 02300 "Earthwork."
 - 2. Section 02630 "Storm Drainage."

1.3 DEFINITIONS

- A. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure-Piping Pressure Ratings: At least equal to system test pressure.

1.5 SUBMITTALS

- A. Shop Drawings: Include plans, elevations, details, and attachments for the following:
 - 1. Precast concrete manholes, including frames and covers.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle precast concrete manholes and other structures according to manufacturer's written rigging instructions.

1.7 PROJECT CONDITIONS

- A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.
- B. Locate existing structures and piping to be closed and abandoned.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify General Contractor and Owner not less than 72 hours in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without General Contractor and Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPES AND FITTINGS

- A. PVC Sewer Pipe and Fittings: According to the following:
 - 1. PVC Sewer Pipe and Fittings: ASTM D 3034, SDR 26 or SDR 23.5, for solvent-cemented or gasketed joints.
 - a. Primer: ASTM F 656.
 - b. Solvent Cement: ASTM D 2564.
 - c. Gaskets: ASTM F 477, elastomeric seals.

2.2 MANHOLES

- A. Normal-Traffic Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for rubber gasketed joints.
1. Diameter: 48 inches minimum, unless otherwise indicated.
 2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
 3. Base Section: 6-inch minimum thickness for floor slab and 5-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
 4. Riser Sections: 5-inch minimum thickness, and lengths to provide depth indicated.
 5. Top Section: Eccentric-cone type, unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
 6. Gaskets: ASTM C 443, rubber.
 7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch-diameter frame and cover.
 8. Steps: Manufactured from 1/2-inch Grade 60 steel reinforced polypropylene complying with ASTM C 478. Steps shall comply with Van Buren Township standards.
- B. Manhole Frames and Covers: Provide type and model of casting as indicated on Van Buren Township standard plans.

2.3 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:
1. Cement: ASTM C 150, Type II.
 2. Fine Aggregate: ASTM C 33, sand.
 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 4. Water: Potable.

- B. Structures; Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water-cementitious materials ratio.
 - 1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 - 2. Reinforcement Bars: ASTM A 615, Grade 60, deformed steel.

- C. Structure Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water-cementitious materials ratio. Include channels and benches in manholes.
 - 1. Manhole Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
 - a. Invert Slope: 1 percent through manhole.
 - 2. Manhole Benches: Concrete, sloped to drain into channel.
 - a. Slope: 8 percent.

2.4 CLEANOUTS

- A. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 02300 "Earthwork" and with requirements of local municipalities.

3.2 IDENTIFICATION

- A. Materials and their installation are specified in Division 2 Section "Earthwork." Arrange for installing green warning tapes directly over piping and at outside edges of underground structures.
 - 1. Use warning tape or detectable warning tape over ferrous piping.
 - 2. Use 12 gauge locating wire over nonferrous piping and over edges of underground structures.

3.3 PIPING APPLICATIONS

- A. General: Include watertight joints.
- B. Refer to Part 2 of this Section for detailed specifications for pipe and fitting products listed below. Use pipe, fittings, and joining methods according to applications indicated.
- C. Gravity-Flow Piping: Use the following:
 - 1. PVC sewer pipe and fittings, solvent-cemented joints, or gaskets and gasketed joints.

3.4 INSTALLATION, GENERAL

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements. Maintain

swab or drag in line, and pull past each joint as it is completed.

- C. Use manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.
- D. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Install gravity-flow system piping at constant slope between points and elevations indicated.
 - 1. Install straight piping runs at constant slope, not less than that specified, where slopes are not indicated.

3.5 PIPE JOINT CONSTRUCTION AND INSTALLATION

- A. General: Join and install pipe and fittings according to installations indicated.
- B. PVC Sewer Pipe and Fittings: As follows:
 - 1. Join pipe and gasketed fittings with elastomeric seals according to ASTM D 2321.
 - 2. Join solvent cement joint pipe and fittings with solvent cement according to ASTM D 2855 and ASTM F 402.
 - 3. Install according to ASTM D 2321.
- C. System Piping Joints: Make joints using system manufacturer's couplings, unless otherwise indicated.
- D. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and that fit both systems' materials and dimensions.

3.6 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Form continuous concrete channels and benches between inlets and outlet.
- C. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere, unless otherwise indicated.
- D. Install precast concrete manhole sections with gaskets according to ASTM C 891.
 - 1. Provide rubber joint gasket complying with ASTM C 443 at joints of sections.
- E. Construct cast-in-place manholes as indicated.

3.7 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use P.V.C. pipe fittings in sewer pipes at branches for cleanouts and P.V.C. pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
- B. Set cleanout frames and covers in earth in cast-in-place concrete block, 12 by 12 by 8 inches deep. Set with tops 1 inch above surrounding grade.
- C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.8 TAP CONNECTIONS

- A. Make connections to existing piping and underground structures so finished Work complies as nearly as practical with requirements specified for new Work.

- B. Make branch connections to underground structures by cutting opening into structure large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through structure wall to conform to shape of and be flush with inside wall, unless otherwise indicated. On outside of structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
 - 1. Use concrete that will attain minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.
 - 2. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
- C. Protect piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.9 FIELD QUALITY CONTROL

- A. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.
 - 1. Place plug in end of incomplete piping at end of day and when work stops.
 - 2. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.
- B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 - 1. Submit separate reports for each system inspection.
 - 2. Defects requiring correction include the following:

- a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 4. Reinspect and repeat procedure until results are satisfactory.
- C. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
1. Do not enclose, cover, or put into service before inspection and approval.
 2. Test completed piping systems according to authorities having jurisdiction.
 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 4. Submit separate reports for each test.
 5. Perform tests according to procedures of authorities having jurisdiction.

END OF SECTION 02530

SECTION 02620 - SUBDRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes subdrainage systems for the following:
 - 1. Catch basins.
- B. Related Section includes the following:
 - 1. Section 02530 "Sanitary Sewerage"
 - 2. Section 02630 "Storm Drainage"

1.3 DEFINITIONS

- A. PVC: Polyvinyl chloride.

1.4 SUBMITTALS

- A. Product Data: For drainage conduit, drainage panels, and geotextile fabrics.
 - 1. Perforated pipe.
 - 2. Geotextile fabrics.

PART 2 - PRODUCTS

2.1 DRAINAGE PIPES AND FITTINGS

- A. Perforated, Corrugated PVC Sewer Pipe and Fittings: ASTM F 800, bell-and-spigot ends, for loose joints except perforations shall conform to requirements of AASHTO M252.

2.2 SOIL MATERIALS

- A. Pea Gravel: Clean, hard, durable, free flowing, naturally rounded particles of rock, free from clay lumps, with 100% passing a 3/8" sieve and not over 5% passing a #8 sieve.

2.3 GEOTEXTILE FILTER FABRICS

- A. Woven or nonwoven geotextile filter fabric of PP or polyester fibers, or combination of both. Flow rates range from 110 to 330 gpm per sq. ft. when tested according to ASTM D 4491. Available styles are flat and sock.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 02300 "Earthwork."

3.2 CATCH BASIN SUBDRAINAGE INSTALLATION

- A. Place supporting layer of pea gravel over compacted subgrade to compacted depth of not less than 6 inches. After installing drainage piping, add pea gravel to top of pipe to perform tests. After satisfactory testing, cover piping with pea gravel to elevation of bottom of aggregate base course and compact pea gravel material.
 - 1. Before installing pea gravel, lay geotextile filter fabric in trench and overlap trench sides. After installing pea gravel, wrap top of pea gravel with geotextile filter fabric.

3.3 PIPING INSTALLATION

- A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
 - 1. Install piping pitched down in direction of flows indicated on Drawings.
 - 2. Lay perforated pipe with perforations down.
 - 3. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.
- B. Install PVC piping according to ASTM D 2321.

3.4 FIELD QUALITY CONTROL

- A. Testing: After installing drainage fill to top of pipe, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

3.5 CLEANING

- A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 02620

SECTION 02630 - STORM DRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes storm drainage outside the building.
- B. Related Sections include the following:
 - 1. Section 02300 "Earthwork."
 - 2. Section 02530 "Sanitary Sewerage."
 - 3. Section 02620 "Subdrainage."

1.3 DEFINITIONS

- A. PVC: Polyvinyl chloride plastic.
- B. C.S.P.: Aluminized corrugated steel pipe.
- C. Drainage Piping: System of piping, fittings and appurtenances for gravity flow of storm drainage.

1.4 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure-Piping Pressure Ratings: At least equal to system test pressure.

1.5 SUBMITTALS

- A. Shop Drawings: Include plans, elevations, details, and attachments for the following:

1. Precast concrete manholes and other structures, including frames, covers, and grates.
 2. Underground stormwater detention piping system.
- B. Design Mix Reports and Calculations: For each class of cast-in-place concrete.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic structures, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle precast concrete manholes and other structures according to manufacturer's written rigging instructions.

1.7 PROJECT CONDITIONS

- A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.
- B. Locate existing structures and piping to be closed and abandoned.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify the General Contractor and Owner not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without General Contractor's and Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPES AND FITTINGS

- A. PVC Sewer Pipe and Fittings: According to the following:
1. ASTM D 3034, Schedule 40, for solvent-cemented or gasketed joints.
 - a. Primer: ASTM F 656
 - b. Solvent Cement: ASTM D 2564
 - c. Gaskets: ASTM F 477, elastomeric seals.
- B. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76, Class III, Wall B for gasketed joints.
1. Gaskets: ASTM C 443, rubber.
- C. Aluminized C.S.P. Sewer Pipe and fittings: According to the following:
1. ASTM A 760, AASHTO M 274, 14 gauge Type II with 1/2"x2-2/3" corrugations, perforated or solid pipe for banded joints. Perforations where indicated to be 1/2" dia. in two rows 45° up from pipe bottom, placed 1' in from each pipe end on 8" centers in valley of corrugation and galvanized painted after drilling.
 - a. 24" wide Type II band with (2) 7" 12 ga. angles and (4) 1/2"X8" band bolts and flange nuts.

2.2 CATCH BASINS

- A. Normal-Traffic, Precast Concrete Catch Basins: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for rubber gasketed joints.
1. Base Section: 6-inch minimum thickness for floor slab and 5-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.

2. Riser Sections: 5-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
3. Top Section: Eccentric-cone type, unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
4. Gaskets: ASTM C 443, rubber.
5. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch-diameter frame and grate.
6. Steps: Manufactured from 1/2-inch Grade 60 steel reinforced polypropylene complying with ASTM C 478. Steps shall comply with Van Buren Township standards.
7. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

- B. Frames and Grates: Provide type and model of casting as indicated on local municipalities standard plans.

2.3 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:
1. Cement: ASTM C 150, Type II.
 2. Fine Aggregate: ASTM C 33, sand.
 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water-cementitious ratio.
1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 2. Reinforcement Bars: ASTM A 615, Grade 60, deformed steel.

2.4 CLEANOUTS

- A. C.S.P. Cleanouts: 24" C.S.P. riser with casting and access ladder as detailed on plans.

- B. P.V.C. Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 02300 "Earthwork."

3.2 PIPING APPLICATIONS

- A. General: Include watertight, silttight, or soiltight joints, unless watertight or silttight joints are indicated.
- B. Refer to Part 2 of this Section for detailed specifications for pipe and fitting products listed below. Use pipe, fittings, and joining methods according to applications indicated.
- C. Gravity-Flow Piping: Use the following:
 - 1. NPS 6: PVC sewer pipe and fittings, solvent-cemented joints, or gaskets and gasketed joints.
 - 2. NPS 12: Reinforced-concrete sewer pipe and fittings, gaskets, and gasketed joints.
 - 3. NPS 24 and 48: Aluminized C.S.P. sewer pipe, risers and fittings and banded joints.

3.3 INSTALLATION, GENERAL

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical.

- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line, and pull past each joint as it is completed.
- C. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- D. Install gravity-flow piping of sizes and in locations indicated. Terminate piping as indicated.
 - 1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
 - 2. Install piping with 24-inch minimum cover.

3.4 PIPE JOINT CONSTRUCTION AND INSTALLATION

- A. General: Join and install pipe and fittings according to installations indicated.
- B. PVC Sewer Pipe and Fittings: As follows:
 - 1. Join solvent-cement joint pipe and fittings with solvent cement according to ASTM D 2855 and ASTM F 402.
 - 2. Join pipe and gasketed fittings with gaskets according to ASTM D 2321.
 - 3. Install according to ASTM D 2321.
- C. Concrete Pipe and Fittings: Install according to ACPA's "Concrete Pipe Installation Manual." Use the following seals:
 - 1. Round Pipe and Fittings: ASTM C 443, rubber gaskets.

- D. C.S.P. Underground Detention System Piping Joints: Make joints using system manufacturer's couplings, unless otherwise indicated.
- E. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and that fit both systems' materials and dimensions.

3.5 CATCH-BASIN INSTALLATION

- A. Construct catch basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.

3.6 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318 and ACI 350R.

3.7 TAP CONNECTIONS

- A. Make connections to existing piping and underground structures so finished Work complies as nearly as practical with requirements specified for new Work.
- B. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.8 FIELD QUALITY CONTROL

- A. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.
 - 1. In large, accessible piping, brushes and brooms may be used for cleaning.

2. Place plug in end of incomplete piping at end of day and when work stops.
 3. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.
- B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
1. Submit separate reports for each system inspection.
 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 4. Reinspect and repeat procedure until results are satisfactory.
- C. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects in accordance with local municipalities requirements.
1. Do not enclose, cover, or put into service before inspection and approval.
 2. Test completed piping systems according to authorities having jurisdiction.
 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 4. Submit separate reports for each test.

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5. Leaks and loss in test pressure constitute defects that must be repaired.
6. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 02630

SECTION 02665 - WATER DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes water systems piping for potable water service and fire protection service outside the building.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure Ratings: Except where otherwise indicated, the following are minimum pressure requirements for water system piping.

- 1. Underground Piping: 250 psig (1725 kPa).

1.4 SUBMITTALS

- A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

- B. Product data, including pressure rating, rated capacity, and settings of selected models for the following:

- 1. Valves.
 - 2. Fire hydrants.
 - 3. Pipe.

- C. Shop drawings for precast concrete pits. Include frames and covers. Include drains when indicated.

1.5 QUALITY ASSURANCE

- A. Comply with requirements of utility supplying water.

- B. Comply with standards of authorities having jurisdiction for fire protection systems. Include materials, hose threads, installation, and testing.

- C. Comply with standards of authorities having jurisdiction for potable water piping and plumbing systems. Include materials, installation, testing, and disinfection.

- D. Provide listing/approval stamp, label, or other marking on equipment made to specified standards.
- E. Product Options: Water systems specialties and accessories are based on specific types, manufacturers, and models indicated. Components by other manufacturers but having equal performance characteristics may be considered, provided deviations in dimensions, operation, and other characteristics do not change design concept or intended performance as judged by Architect. The burden of proof of equality of products is on Contractor.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves, including fire hydrants, for shipping as follows:
 - 1. Ensure that valves are dry and internally protected against rust and corrosion.
 - 2. Protect valves against damage to threaded ends, flange faces, and weld ends.
 - 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. Storage: Use the following precautions for valves, including fire hydrants, during storage.
 - 1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
 - 2. Protect valves from weather. Store valves indoors and maintain temperature higher than ambient dew point temperature. Support valves off-ground or pavement watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle valves and fire hydrants whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use handwheels or stems as lifting or rigging points.
- D. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- E. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- F. Protect flanges, fittings, and piping specialties from moisture and dirt.

1.7 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.
- B. Verify that water system piping may be installed in compliance with original design and referenced standards.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate connection to water main with utility company, Construction Manager and Owner.
- B. Coordinate with pipe materials, sizes, entry locations, and pressure requirements of fire protection systems piping.
- C. Coordinate with other utility work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with the Van Buren Township Standard Specifications for Construction and the Standard Water Main Detail Sheet:
 - 1. Drilling Machine Corporation Stops:
 - a. Mueller Co., Grinnell Corp. (H15000)
 - 2. Brass Corporation Stops and Valves:
 - a. Mueller Co, Grinnell Corp.
 - 3. Gate Valves:
 - a. East Jordan Iron Works, Inc.
 - b. Mueller Co., Grinnell Corp.
 - c. U.S. Pipe & Foundry Co.
 - 4. Dry-Barrel Fire Hydrants:
 - a. East Jordan Iron Works, Inc.

2.2 PIPES AND TUBES

- A. Refer to Part 3 Article "Piping Applications" for identification of systems where pipe and tube materials specified below are used.
- B. Ductile-Iron Pipe: AWWA C151, Class 54.
 - 1. Lining: AWWA C104, double cement lining with bituminous

seal coat.

2. Gaskets, Glands, and Bolts and Nuts: AWWA C111.
3. Push-On-Joint-Type Pipe: AWWA C111, rubber gaskets.
4. Mechanical-Joint-Type Pipe: AWWA C111, rubber gaskets, ductile- or cast-iron glands, and steel bolts and nuts.

2.3 PIPE AND TUBE FITTINGS

- A. Refer to Part 3 Article "Piping Applications" for identification of systems where pipe and tube fitting materials specified below are used.
- B. Ductile-Iron and Cast-Iron Pipe Fittings: AWWA C110, ductile-iron compact fittings, 250-psig (1725 kPa) pressure rating.
 1. Lining: AWWA C104, cement mortar.
 2. Gaskets: AWWA C111, rubber.

2.4 JOINING MATERIALS

- A. Refer to Part 3 Article "Piping Applications" for identification of systems where joining materials specified below are used.
- B. Ductile-Iron Pipe and Ductile-Iron or Cast-Iron Fittings: The following materials apply:
 1. Push-On Joints: AWWA C111 rubber gaskets and lubricant.
 2. Mechanical Joints: AWWA C111 ductile-iron or gray-iron glands, high-strength steel bolts and nuts, and rubber gaskets.
 3. Flanged Joints: AWWA C115 ductile-iron or gray-iron pipe flanges, rubber gaskets, and high-strength steel bolts and nuts.
 - a. Gaskets: Rubber, flat face, 1/8 inch (3 mm) thick except where other thickness is indicated; and full-face or ring type except where other type is indicated.
 - b. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, except where other material is indicated.
- C. Pipe Couplings: Iron-body sleeve assembly, fabricated to match outside diameters of pipes to be joined.
 1. Sleeve: ASTM A 126, Class B, gray iron.
 2. Followers: ASTM A 47, Grade 32510, or ASTM A 536 ductile

- iron.
- 3. Gaskets: Rubber.
- 4. Bolts and Nuts: AWWA C111.
- 5. Finish: Enamel paint.

2.5 VALVES

- A. Furnish and install in accordance with the Van Buren Township Standard Specifications for construction and the Standard Water Main Detail Sheet.
- B. Nonrising Stem Gate Valves 3 Inches (80 mm) and Larger: AWWA C509 or C515, cast-iron double disc, bronze disc and seat rings, bronze stem, cast-iron or ductile-iron body and bonnet, stem nut, 200-psig (1380 kPa) working pressure, mechanical joint ends. The direction of turning to open shall be left.
- C. Valve Boxes: Cast-iron box having top section and cover with lettering "WATER", bottom section with base of size to fit over valve and barrel approximately 5 inches (124 mm) in diameter, and adjustable cast-iron extension of length required for depth of bury of valve.

2.6 FIRE HYDRANTS

- A. Furnish and install in accordance with the Van Buren Township Standard Specifications for Construction and the Standard Water Main Detail Sheet.
- B. General: Cast-iron body, compression-type valve, opening against pressure and closing with pressure, 6-inch (150 mm) mechanical joint inlet, 250-psig (1725 kPa) working pressure.
- C. Outlet Threads: NFPA 1963, with City of Detroit external hose thread. Include cast-iron caps with steel chains.
- D. Operating and Cap Nuts: City of Detroit Standard.
- E. Direction of Opening: Open hydrant valve by turning operating nut to the left, or counterclockwise.
- F. Finish: Red exterior alkyd gloss enamel paint.
- G. Dry-Barrel Fire Hydrants: AWWA C502, two 4-inch (100mm) pumper nozzles, 5-1/4-inch (133 mm) main valve and 6-inch (150 mm) mechanical joint inlet.

2.7 ANCHORAGES

- A. Bars: ASTM A 30S.
- B. Concrete Reaction Backing: Portland cement concrete mix, 3500 psi (20.7 Mpa) at 28 days.
 - 1. Cement: ASTM C 150, Type 1.
 - 2. Fine Aggregate: ASTM C 33, crushed sand.
 - 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 - 4. Water: Potable.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Section 02300 "Earthwork".

3.2 PIPING APPLICATIONS

- A. Refer to Part 2 of this Section for detailed specifications for pipe and fittings products listed below. Use pipe, tube, fittings, and joining methods according to the following applications. Piping in pits and inside building may be joined with flanges or couplings, instead of joints indicated, for grooved-end AWWA-size piping.
- B. Use pipe, tube, fittings, and joining methods according to following applications:

- 1. 4 Inches (100 mm) to 12 inches (300 mm): Class 54, ductile-iron pipe, ductile-iron compact fittings, and push-on or mechanical joints.

3.3 JOINT CONSTRUCTION

- A. Ductile-Iron Piping Gasketed Joints: Construct joints according to AWWA C600.
- B. Flanged Joints: Align flanges and install gaskets. Assemble joints by sequencing bolt tightening. Use lubricant on bolt threads.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. General Locations and Arrangements: Drawings indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and

calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated except where deviations to layout are approved on coordination drawings.

- B. Install piping at indicated slope.
- C. Install components having pressure rating equal to or greater than system operating pressure.
- D. Install piping free of sags and bends.
- E. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
- F. Install fittings for changes in direction and branch connections.

3.5 PIPING INSTALLATION

- A. Water Main Connection: Tap water main with size and in location as indicated according to requirements of water utility.
- B. Install ductile-iron pipe and ductile-iron and cast-iron fittings according to AWWA C600.
- C. Bury piping at minimum depth of 6 feet below finished grade and in accordance with the Van Buren Township Standard

Specifications for Construction and the Standard Water Main Detail Sheet.

3.6 ANCHORAGE INSTALLATION

- A. Anchorages: Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
 - 1. Gasketed-Joint, Ductile-Iron Piping: According to AWWA C600.
- B. Apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of installed ferrous anchorage devices.

3.7 VALVE INSTALLATION

- A. General Application: Use mechanical-joint-end valves for 3-inch (80 mm) and larger buried installation. Use threaded-and

flanged-end valves for installation in pits and inside building.

- B. AWWA-Type Gate Valves: Comply with AWWA C600. Install buried valves with stem pointing up and with cast-iron valve box, unless noted otherwise on local Municipalities' standard detail sheets

3.8 FIRE HYDRANT INSTALLATION

- A. AWWA-Type Fire Hydrants: Comply with AWWA M17. Install with gate valve and provision for drainage as indicated.

3.9 FIELD QUALITY CONTROL

- A. Hydrostatic Tests: The test shall be made at a pressure of 150 pounds per square inch for water main. The full pressure shall be maintained in each section being tested, by pumping water into the pipe for a period of at least 2 hours. Any faulty pipe, fittings, gate valves or other accessories discovered during testing shall be replaced with sound material, and the test shall be repeated until specific requirements are met. The maximum permissible leakage (as measured by the amount of water pumped into the pipe during the test period) shall not exceed a rate of 0.10 gallons per hour per inch diameter of main per 1000 linear feet of pipe.

All tests shall comply with the requirements of, and be witnessed by, the local agency having jurisdiction over the water system.

3.10 CLEANING

- A. Clean and disinfect water distribution piping as follows:
 - 1. Purge new water distribution piping systems and parts of existing systems that have been altered, extended, or repaired prior to use.
 - 2. Use purging and disinfecting procedure prescribed by authority having jurisdiction or, if method is not prescribed by that authority, use procedure described in AWWA C651 or as described below:
 - a. Comply with NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
 - b. Fill system or part of system with water/chlorine solution containing at least 50 parts per million of

chlorine. Isolate (valve off) system or part thereof and allow to stand for 24 hours.

- c. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 parts per million of chlorine; isolate and allow to stand for 3 hours.
- d. Following allowed standing time, flush system with clean, potable water until chlorine does not remain in water coming from system.
- e. Submit water samples in sterile bottles to authority having jurisdiction. Repeat procedure if biological examination made by authority shows evidence of contamination.

B. Prepare reports for purging and disinfecting activities.

END OF SECTION 02665

SECTION 02740 - HOT-MIX ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. All work to be performed under this Section shall be in accordance with the Van Buren Township Paving Standard Detail sheets.

1.2 SUMMARY

- A. Work under this Section includes the following:
 - 1. Hot-mix asphalt paving.
 - 2. Hot-mix asphalt patching.
- B. Related Sections include the following:
 - 1. Section 02300 "Earthwork."
 - 2. Section 02751 "Concrete Pavement"

1.3 DEFINITIONS

- A. Hot-Mix Asphalt Paving Terminology: Refer to MDOT 2012 Standard Specifications for Construction.
- B. MDOT: Michigan Department of Transportation.
- C. HMA: Hot Mix Asphalt

1.4 SYSTEM DESCRIPTION

- A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of standard specifications of the following:
 - 1. Standard Specification: State of Michigan, Department of Transportation (MDOT), 2012 Standard Specification for Construction.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
- B. Job-Mix Designs: For each job mix proposed for the Work.
- C. Material Test Reports: For each paving material.
- D. Material Certificates: For each paving material, signed by manufacturers.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer.
 - 1. Manufacturer shall be a paving-mix manufacturer registered with and approved by authorities having jurisdiction or the Michigan Department of Transportation.
- B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated, as documented according to ASTM E 548.
- C. Regulatory Requirements: Comply with State of Michigan, Department of Transportation (MDOT), and 2012 Standard Specification for Construction.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply HMA materials if subbase is wet or excessively damp or if the following conditions are not met:
 - 1. Prime and Tack Coats: Minimum surface temperature of 60 deg F.
 - 2. Slurry Coat: Comply with weather limitations of ASTM D 3910.
 - 3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. Mineral Filler: ASTM D 242, rock or slag dust, hydraulic cement, or other inert material.
- B. Paving Mixture Aggregates
 - 1. Fine Aggregates shall conform to MDOT Designation 1100T and 1100L.
 - 2. Mineral Filler shall conform to MDOT Designation 3MF.

2.2 ASPHALT MATERIALS

- A. Bond Coat: SS-1H.

2.3 MIXES

- A. Hot-Mix Asphalt: Provide dense, hot-laid, hot-mix asphalt plant mixes designed according to procedures in Michigan Department of Transportation "2012 Standard Specifications for Construction".
- B. Emulsified-Asphalt Slurry: ASTM D 3910, Type I , consisting of emulsified asphalt, fine aggregate, and mineral fillers.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.
- B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 PATCHING

- A. Hot-Mix Asphalt Pavement: Sawcut perimeter of patch to full depth and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Excavate trench as required for utility installation. Maintain maximum 1:1 side slopes on utility trench. Backfill trench and compact per Section 2300 "Earthwork."
- B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd.
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances and surroundings. Remove spillages and clean affected surfaces.
- C. Patching: Place and compact asphalt pavement per paving sections shown on construction drawings. Finish flush with adjacent surfaces.

3.3 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
 - 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

3.4 PLACING HOT-MIX ASPHALT

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in the number of lifts and thicknesses indicated.
 2. Place hot-mix asphalt wearing course in single lift.
 3. Spread mix at minimum temperature of 250 deg F.
 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.
 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.
- 3.5 JOINTS
- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
1. Clean contact surfaces and apply tack coat to joints.
 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
 3. Offset transverse joints, in successive courses, a minimum of 24 inches.
 4. Construct transverse joints as described in AI MS-22, "Construction of Hot Mix Asphalt Pavements."
 5. Compact joints as soon as hot-mix asphalt will bear roller weight without displacement.
 6. Compact HMA at joints to a density within 2 percent of specified course density.

3.6 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
 - 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 - 1. Average Density: 96 percent of reference laboratory density according to AASHTO T 245, but not less than 94 percent nor greater than 100 percent.
 - 2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.7 INSTALLATION TOLERANCES

- A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Leveling Course: Plus or minus 1/2 inch.
 - 2. Wearing Course: Plus 1/4 inch, no minus.
- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Leveling Course: 1/4 inch.
 - 2. Wearing Course: 1/8 inch.
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: A qualified independent testing and inspecting agency will be engaged by the Owner to perform field tests and inspections and to prepare test reports.
 - 1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.
- B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

- D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979 or AASHTO T 168.
 - 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
 - 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
 - a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
 - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.9 DISPOSAL

- A. Remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow excavated materials to accumulate on-site.

END OF SECTION 02740

SECTION 02751 - CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes exterior cement concrete pavement for the following:
 - 1. Curbs and gutters.
 - 2. Walkways.
 - 3. Drives
- B. Related Sections include the following:
 - 1. Section 02300 "Earthwork" for subgrade preparation, grading, and base course.
 - 2. Section 03001 "Concrete Work" for general building applications of concrete.

1.3 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials.

1.4 QUALITY ASSURANCE

- A. **Installer Qualifications:** An experienced installer who has completed pavement work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. **Testing Agency Qualifications:** An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
- C. **Concrete Testing Service:** Owner will engage a qualified independent testing agency to perform material evaluation tests and determine whether tested work complies with or deviates from specified requirements.

1.5 PROJECT CONDITIONS

- A. **Traffic Control:** Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 FORMS

- A. **Form Materials:** Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
 - 1. Use flexible or curved forms for curves of a radius 100 feet or less.
- B. **Form-Release Agent:** Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.2 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- B. Reinforcement Bars: ASTM A 615, Grade 60, deformed.
- C. Plain Steel Wire: ASTM A 82, as drawn.
- D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement bars, welded wire fabric, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
 - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2.3 CONCRETE MATERIALS

- A. General: Use the same brand and type of cementitious material from the same manufacturer throughout the Project.
- B. Portland Cement: ASTM C 150, Type I.
 - 1. Fly Ash: Not allowed.
- C. Aggregate: ASTM C 33, uniformly graded.
 - 1. Do not use fine or coarse aggregates containing substances that cause spalling.
- D. Water: ASTM C 94.

2.4 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.05 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures.
- B. Air-Entraining Admixture: ASTM C 260.
- C. Water-Reducing Admixture: ASTM C 494, Type A.
- D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
- E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
- F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.5 CURING MATERIALS

- A. Water: Potable.
- B. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- C. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.6 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.
- B. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
 - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.7 CONCRETE MIXES

- A. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the trial batch method.
 - 1. Do not use Owner's field quality-control testing agency as the independent testing agency.
- C. Proportion mixes to provide concrete with the following properties:
 - 1. Compressive Strength (28 Days): 4000 psi.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.50.
 - 3. Slump Limit: 4 inches.
 - a. Slump Limit for Concrete Containing High-Range Water-Reducing Admixture: Not more than 8 inches after adding admixture to plant- or site-verified, 2- to 3-inch slump.
- D. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 6 percent plus or minus 1 percent.
- E. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd..

2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94 and ASTM C 1116.
 - 1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

2. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Proof-roll prepared base course surface to check for unstable areas and verify need for additional compaction. Proceed with pavement only after nonconforming conditions have been corrected and base course is ready to receive pavement.
- B. Remove loose material from compacted base surface immediately before placing concrete.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form release agent to ensure separation from concrete without damage.

3.3 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating reinforcement and with recommendations in CRSI's "Placing Reinforcing Bars" for placing and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

- D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.4 JOINTS

- A. General: Construct construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
 - 1. When joining existing pavement, place transverse joints to align with previously placed joints.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour, unless pavement terminates at isolation joints.
 - 1. Provide preformed galvanized steel or plastic keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
 - 2. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
 - 3. Use epoxy bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals of 50 feet, unless otherwise indicated.
 - 2. Extend joint fillers full width and depth of joint.

3. Terminate joint filler less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.
- E. Control Joints: Form control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint with groover tool to the following radius. Repeat grooving of control joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
 - a. Radius: 1/4 inch.
 2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random control cracks.
- F. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to the following radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.
1. Radius: 1/4 inch.

3.5 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Remove snow, ice, or frost from base course surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten base course to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.
- D. Comply with requirements and with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery, at Project site, or during placement.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.
 - 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
- H. Screed pavement surfaces with a straightedge and strike off. Commence initial floating using bull floats or darbies to form an open textured and uniform surface plane

before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading dry-shake surface treatments.

- I. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.

- J. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
 2. Do not use frozen materials or materials containing ice or snow.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

- K. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows when hot-weather conditions exist:
 1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, reinforcement steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.6 CONCRETE FINISHING

- A. General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots, and fill low spots. Refloat surface immediately to uniform granular texture.
 1. Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3.7 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and follow recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

- C. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.
- D. Curing Methods: Cure concrete by moisture curing, curing compound, or a combination of these as follows:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with water.
 - 2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.8 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
 - 1. Elevation: 1/4 inch.
 - 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 - 3. Surface: Gap below 10-foot- long, unlevelled straightedge not to exceed 1/4 inch.
 - 4. Contraction Joint Depth: Plus 1/4 inch, no minus.
 - 5. Joint Width: Plus 1/8 inch, no minus.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.
- B. Testing Services: Testing shall be performed according to the following requirements:
 - 1. Sampling Fresh Concrete: Representative samples of fresh concrete shall be obtained according to ASTM C 172, except modified for slump to comply with ASTM C 94.

2. Slump: ASTM C 143; one test at point of placement for each truckload. Additional tests will be required when concrete consistency changes.
 3. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test, but not less than one test for each day's pour of each type of air-entrained concrete.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each set of compressive-strength specimens.
 5. Compression Test Specimens: ASTM C 31; one set of four standard cylinders for each compressive-strength test. Cylinders shall be molded and stored for laboratory-cured test specimens unless field-cured test specimens are required.
 6. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd.. One specimen shall be tested at 7 days and two specimens at 28 days; one specimen shall be retained in reserve for later testing if required.
 7. When frequency of testing will provide fewer than five compressive-strength tests for a given class of concrete, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 8. When total quantity of a given class of concrete is less than 50 cu. yd., Architect may waive compressive-strength testing if adequate evidence of satisfactory strength is provided.
 9. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive compressive-strength test results equal or exceed specified compressive strength and no individual compressive-strength test result falls below specified compressive strength by more than 500 psi.
- C. Test results shall be reported in writing to Architect, General Contractor, concrete manufacturer, and installing Contractor within 24 hours of testing. Reports of

compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in pavement, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

- D. Additional Tests: Testing agency shall make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

3.10 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section.
- B. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- C. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 02751

SECTION 02760 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

Furnishing and applying permanent pavement markings.

1.2 DESCRIPTION

- A. Provide all materials, labor, equipment, and services necessary to complete all traffic lane and parking lot striping as indicated in the Construction Documents.
- B. Work includes, but not limited to painting of letters, markings, stripes on the pavement surface applied in accordance with this Section and at the locations shown on the Plans or as directed by the Architect/Engineer.

1.3 QUALITY ASSURANCE

- A. All work under this section shall be performed in accordance with the current 2012 MDOT Standard Specifications for Construction, unless otherwise indicated on the drawings.
- B. All physically handicapped / barrier free markings shall be in accordance with current ADA requirements and the current Michigan Barrier Free Graphics Design Manual.
- C. Each paint container shall be clearly marked showing the name and address of manufacturer, description of material, date of packaging, and volume and weight of contents.
- D. Use only personnel completely trained and experienced in installation of materials and equipment.

1.4 SUBMITTALS

- A. Manufacturer's literature: Submit descriptive product data of materials, installation methods and procedures.
- B. Certification of compliance: Furnish a certification from manufacturer that material for this project has been sampled, tested and complies with requirements of specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The paint shall meet the specifications set forth in Section 920 of the 2012 MDOT Standard Specifications for Construction, unless otherwise indicated on the drawings.
- B. Color shall be as Specified on the Plans or as follows:

<u>Striping Item</u>	<u>Color</u>	<u>Stripe Width</u>
Stop Bars	White	12"
Traffic Lanes	Yellow	4"
Bus Lanes	White	4"
Standard Parking Stalls	Yellow	4"
Barrier Free Parking Stalls	Blue	4"
No Parking Areas	Yellow	6"
Barrier Free Access Areas	Blue	4"
Curbs	As Noted on Plans	Paint Face of Curb

PART 3 - EXECUTION

3.1 WEATHER LIMITATIONS

- A. The painting shall be performed only when the existing surface is dry and clean, when the minimum atmospheric temperature is in accordance with Table 811-2 of the 2012 MDOT Standard Specifications for Construction, and when the weather is not excessively windy, dusty or foggy.

3.2 EQUIPMENT

- A. All equipment for the Work shall be approved by the General Contractor and shall include the apparatus necessary to properly clean the existing surface, a mechanical marking machine, and such auxiliary hand painting equipment as may be necessary to satisfactorily complete the job.
- B. The mechanical marker shall be an approved self-propelled marking machine suitable for application of traffic paint. It shall produce an even and uniform film thickness at the required coverage and shall be designed so as to apply markings of uniform cross-sections and clear-cut edges without running or spattering and within the limits for straightness set forth herein.
- C. Suitable adjustments shall be provided on the sprayer/sprayers of a single machine or by furnishing additional equipment for painting the width required.

3.3 PREPARATION OF EXISTING SURFACE

- A. Immediately before application of the paint, the existing surface shall be cleaned, dry and entirely free from dirt, grease, oil, acids, laitance, or other foreign matter which could reduce the bond between the coat of paint and the pavement. Areas which cannot be satisfactorily cleaned by brooming and blowing shall be scrubbed as directed with a water solution of tri-sodium phosphate or an approved equal solution. After scrubbing, the solution shall be rinsed off and the surface dried prior to painting.
- B. Existing markings or stripes, which are to be abandoned or removed, shall be obliterated or obscured by the best methods suited for the purpose and to the satisfaction of the Owner.

3.4 LAYOUTS AND ALIGNMENT

- A. The Contractor is responsible for laying out proposed striping, which is to be approved by the Owner, before the Contractor is to proceed with the striping procedure. The Contractor is to insure that all subsequent striping meets the quality of the approved application.
- B. On those sections of pavements where no previously applied figures, markings, or stripes are available to serve as a guide, suitable layouts and lines of proposed stripes shall be spotted in advance of the paint application. Control points shall be spaced at such intervals as will ensure accurate location of all markings.
- C. The Contractor shall provide an experienced Technician to supervise the location, alignment, layout, dimensions and application of the paint.

3.5 APPLICATION

- A. Markings shall be applied at the locations and to the dimensions and spacing indicated on the Plans or as specified. Paint shall not be applied until the indicated alignment is laid out and the conditions of the existing surface have been approved by the Owner.
- B. The paint shall be mixed in accordance with the manufacturer's instructions before application. The paint shall be thoroughly mixed and applied to the surface of the pavement with the marking machine at its original consistency without the addition of thinner. If the paint is applied by brush, the surface shall receive two (2) coats; the first coat shall be thoroughly dry before the second coat is applied.
- C. Prior to marking of the pavement, fourteen (14) days shall elapse from the application of the bituminous seal coat, slurry seal or the placement of the HMA surface course.

D. In the application of straight stripes, any deviation in the edges exceeding 1/2-inch in 50-feet shall be obliterated and the marking corrected. The width of the markings shall be as designated within a tolerance of 5 percent (5%).

3.6 PROTECTION

A. After applications of the paint, all markings shall be protected while the paint is drying. The fresh paint shall be protected from injury or damage of any kind. The Contractor shall be directly responsible and shall erect or place suitable warning signs, flags, or barricades, protective screens or coverings as required. Markings defaced by traffic or pedestrians shall be reinstalled at the contractor's expense.

END OF SECTION 02760

SECTION 02821 - VINYL FENCING AND GATES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Privacy Fence
- B. Post Caps
- C. Gates
- D. Gate Hardware

1.2 RELATED SECTIONS

- A. Section 033000 - Cast-in-Place Concrete.

1.3 REFERENCES

- A. ASTM D 1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

- A. Provide pool fencing to meet applicable code requirements.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: Submit shop drawings for each product and accessory required. Include information not fully detailed in manufacturer's standard product data.

- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, minimum size 3 inches (76 mm) square, representing actual product, color, and patterns.
- F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- G. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic cleaning and maintenance of all components.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm engaged in the manufacture of vinyl fence and gates of types and sizes specified, and whose products have been in satisfactory use in similar service for a minimum of five years.
- B. Installer Qualifications: A firm with a minimum of two years of successful installation experience with projects utilizing vinyl fence and gates similar in type and scope to that required for this Project.
- C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Finish areas designated by Architect.
 - 2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
 - 3. Refinish mock-up area as required to produce acceptable work.
 - 4. Accepted mock-ups shall be comparison standard for remaining Work
- D. Pre-Installation Conference: Conduct pre-installation conference in accordance with Section 01 20 00 - Price and Payment Procedures. Date and time of the pre-installation conference shall be acceptable to the Owner and the Architect.

1. Prior to commencing the installation, meet at the Project site to review the material selections, installation procedures, and coordination with other trades.
2. Mock-ups shall be reviewed during the pre-installation conference.
3. Pre-installation conference shall include the Contractor, the Installer, and any trade that requires coordination with the work.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project site in manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and lot number, if any.
- B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.8 SEQUENCING

- A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.
- B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.9 PROJECT CONDITIONS

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

1.10 WARRANTY

- A. Lifetime Limited, Non-Prorated Warranty on Material and 5 Year Prorated Labor Warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Bufftech Vinyl Fence Products, as manufactured by CertainTeed, 800-233-8990.
- B. Substitutions: Not permitted.

2.2 MATERIALS

- A. PVC: Poly Vinyl Chloride (PVC) formulated to resist impact and for Ultra Violet (UV) stabilization. Extruded products meets or exceeds ASTM D I784.

2.3 PRIVACY FENCE

- A. Style: Chesterfield CertaGrain Privacy Fence.
 - 1. Height:
 - a. 72 inch
 - 2. Section Width:
 - a. 6 foot
 - 3. Deco Rails: 2 inch by 6-1/2
 - 4. Midrail: Provide for 64 inch, 84 inch and 72 inch high fence sections.
 - 5. Tongue and Groove Panels: 7/8 inch by 8-1/2 inch with 4 inch appearance.
 - 6. Posts: 5 inch by 5 inch.
 - 7. Gates and Posts:
 - a. Matching fence style.
 - 8. Colors:
 - a. White

2.4 POST CAPS

- A. Vinyl Post Cap
 - 1. Size:
 - a. 6 inch Dental Molding (White)

2.5 GATE HARDWARE

- A. Gate Hardware:
 - 1. Latch: Stainless steel with aluminum latch clapper
 - 2. Aluminum Handle
 - 3. Hinge Set - Select
 - 4. Drop Pin Kit - Select

5. 2 Way Latch Set
 6. Finish/Color: Powder coated
 - a. Black
- B. Gate Hardware: Stainless steel with aluminum latch clappers.
1. Aluminum Gate Handle.
 2. Gate Wheel.
 3. Aluminum Gate Brace.
 4. Hinge Set
 5. Commercial Latch: Stainless steel with aluminum latch clapper.
 - a. Drop Pin Kit - Commercial
 - b. Spring Set - Commercial
 6. Finish/Color: Powder coated
 - a. Black

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until conditions have been properly prepared.
- B. Verification of Conditions: Examine locations where fencing is to be installed for any conditions detrimental to the proper and timely completion of the work.
- C. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare the grade and remove surface irregularities, if any, which may cause interference with the installation of the fence.
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Set posts and gate posts for gate openings as indicated on the Drawings.
- C. Center and align posts, place concrete around posts and vibrate or tamp for consolidation. Recheck vertical and top alignment of posts, and make necessary corrections.
- D. Install gates plumb, level, and secure for full opening without interference. For double gates, install drop rod. Adjust hardware for smooth operation.

3.4 CLEANING

- A. Touch-up, repair, or replace damaged products before Substantial Completion.
- B. Clean the work according to manufacturer's written instructions. Post hole excavations shall be scattered uniformly away from the posts. Clean fence with mild household detergent and rinse well with clean water. Remove mortar from exposed posts using a 10 percent solution of muriatic acid followed immediately by several rinses with clean water.

3.5 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 02835 - ORNAMENTAL METAL FENCING SYSTEM

MONTAGE PLUS - MAJESTIC 3-RAIL STYLE

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. The Fencing Contractor shall provide all labor, materials, and appurtenances necessary for installation of the ornamental metal fencing system defined herein.

1.02 SYSTEM DESCRIPTION

- A. The manufacturer shall supply a total ornamental metal fencing system of the Majestic design. The system shall include all components (i.e., pickets, rails, posts, gates and hardware including latch-forked type or plunger bar type with padlock eye) required.

1.03 QUALITY ASSURANCE

- A. The Fencing Contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved and materials and techniques specified.

1.04 REFERENCES

- A. ASTM A526-Steel Sheet Zinc-Coated (Galvanized by the Hot Dip Process)
- B. ASTM B117-Salt Spray Testing

1.05 SUBMITTAL

- A. The manufacturer's literature shall be submitted prior to installation.

1.06 PRODUCT HANDLING AND STORAGE

- A. Upon receipt at the job site, all materials shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism, and theft.

PART 2 - MATERIALS

2.01 MANUFACTURER

- A. The ornamental metal fencing system shall conform to MONTAGE PLUS, Majestic 3-Rail style manufactured by Ameristar Fence Products, Inc., in Tulsa, Oklahoma.

2.02 MATERIAL

- A. The materials for fence framework (i.e., pickets, rails, and posts) shall be manufactured from coil steel having a minimum yield strength of 50,000 psi. The steel shall be galvanized to meet the requirements of ASTM A526 with a minimum zinc coating weight of .90 ounces per square foot (coating Designation G-90), hot-dip process. Galvanized framework shall be subject to a six stage pretreatment/wash (with zinc phosphate) followed by "PERMACOAT™", an electrostatic spray application of a two coat powder system. The base coat is a thermosetting epoxy powder coating (gray in color) with a minimum thickness of 2-4 mils. The top coat is a "no-mar" TGIC polyester powder coat finish with a minimum thickness of 2-4 mils. The color shall be black. Coated galvanized framework shall have a salt spray resistance of 3,500 hours using ASTM B117 without loss of adhesion.
- B. Material for fence pickets shall be 4'-0" high and 1" square x 16ga. tubing. The cross-sectional shape of the rails shall conform to the manufacturer's **Forerunner™** design with outside cross-section dimensions of 1.75" square and a minimum thickness of 14ga. Post spacing shall be 71-1/4" for 6' o.c. nominal with 2-1/2" square posts. Picket holes in the **Forerunner** rail shall be spaced 4.98" o.c. Picket retaining rods shall be 0.125" dia. galvanized steel. Posts shall be a minimum of 2-1/2" square x 12ga.

Rubber grommets shall be supplied to seal all picket-to-rail intersections.

2.03 FABRICATION

- A. Pickets, rails, and posts shall be pre-cut to specified lengths. **Forerunner** rails shall be pre-punched to accept pickets.
- B. Grommets shall be inserted into the pre-punched holes in the rails and pickets shall be inserted through the grommets so that pre-drilled picket holes align with the internal upper raceway of the **Forerunner** rails (Note: This can best be accomplished by making an alignment jig). Retaining rods shall be inserted into each **Forerunner** rail so that they pass through the predrilled holes in each picket.
- C. Completed sections (i.e., panels) shall be capable of supporting a 600 lb. load applied at midspan without permanent deformation. Panels shall be biasable to a 25% change in grade.
- D. Ornamental Gates shall be fabricated using **MONTAGE PLUS** panel material and gate ends having the same outside cross-section dimensions as the **Forerunner** rail. Each upright and rail intersection shall be joined by welding. Each picket and rail intersection shall also be joined by welding.

PART 3 - EXECUTION

3.01 PREPARATION

- A. All new installation shall be laid out by the Fencing Contractor in accordance with the construction plans.

3.02 INSTALLATION

- A. Fence posts shall be set at spacings of 71-1/4" plus or minus 1/2". Gate posts shall be spaced according to the gate openings specified in the construction plans. **MONTAGE PLUS** panels shall be attached to posts using panel brackets supplied by the bolt-on hardware supplied by manufacturer.

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2017 RENOVATIONS

BID PACKAGE NO. 1E

171734

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Anchor all posts into 8" dia. x 42" deep concrete
foundations.

3.03 CLEANING

A. The contractor shall clean the jobsite of excess materials.

END OF SECTION 02835

SECTION 02836 - ALUMINUM CANTILEVER GATE SYSTEM

Transport II - MAJESTIC 4'-0" HIGH, Enclosed Track Industrial
Aluminum Cantilever Gate System

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. The Fencing Contractor shall provide all labor, materials, and appurtenances necessary for installation of the ornamental metal fencing system defined herein.

1.02 SYSTEM DESCRIPTION

- A. The manufacturer shall supply an Enclosed Track Industrial Aluminum Cantilever Gate System. The system shall include all components (i.e., pickets, rails, posts, gate, operator, controls and hardware) required.

1.03 QUALITY ASSURANCE

- A. The Fencing Contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved and materials and techniques specified.

1.04 REFERENCES

- A. ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.
- B. ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
- C. ASTM D523 - Test Method for Specular Gloss.
- D. ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.
- E. ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
- F. ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
- G. ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
- H. ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.
- I. ASTM F1184 - Industrial & Commercial Horizontal Slide Gates

1.05 SUBMITTAL

- A. The manufacturer's literature shall be submitted prior to installation.

1.06 PRODUCT HANDLING AND STORAGE

- A. Upon receipt at the job site, all materials shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism, and theft.

PART 2 - MATERIALS

2.01 MANUFACTURER

- A. All industrial ornamental aluminum cantilever gates shall conform to the Ameristar® TransPort II gate system, manufactured by Ameristar Fence Products, Inc., in Tulsa, Oklahoma. The project gate schedule shall include the following additional information for each cantilever gate included in the project scope: Gate opening widths and locations as indicated on drawings. Contact Bob Miller: 586-767-7819

2.02 MATERIAL

- A. The materials used for cantilever gate framing (i.e., uprights, diagonal braces and pickets or pales) shall be manufactured from ASTM B221 aluminum (designation 6063-T-6) with a yield strength of 25,000 PSI, a tensile strength of 30,000 PSI and a standard mill finish. The TransPort® Fast-Trak™ rails shall be manufactured from ASTM B221 aluminum (designation 6063-T-6) with minimum yield strength of 25,000 PSI, a tensile strength of 30,000 PSI and a standard mill finish.
- B. Material for diagonal bracing and uprights shall be 2" sq. x ¼" aluminum. The design of the top and bottom enclosed track shall conform to the manufacturers 5" x 2" Fast-Trak system. Material for pickets shall be 1" x 1/8" wall aluminum.
- C. Internal roller truck assembly shall be self-aligning swivel ball-and-socket type running on four bearing wheels.

Internal roller truck assembly shall be affixed to the hanger bracket by means of a 5/8" diameter industrial-grade rod end/center bolt, with a minimum static load rating of 10,000 pounds. Attachment of the center bolt to the truck body shall be by means of a swivel joint to ensure equivalent and consistent loading on all bearing wheels and internal track surfaces throughout the travel of the gate.

2.03 FABRICATION

- A. Pickets, enclosed track, uprights and diagonal bracing shall be pre-drilled and labeled for easy assembly. All components shall be pre-cut to specified lengths.
- B. Top and bottom rail extrusions shall be mechanically fastened to vertical uprights and reinforced with diagonal braces, as required by drawing.
- C. The manufactured components shall be subjected to the Ameristar thermal stratification coating process (high-temperature, in-line, multi-stage, and multi-layer) including, as a minimum, a six-stage pretreatment/wash and an electrostatic spray application of a polyester finish. The topcoat shall be a "no-mar" TGIC polyester powder coat finish with a minimum thickness of 2 mils (0.0508mm). The color shall be (specify Black, Bronze, White, or Desert Sand). The stratification-coated framework shall be capable of meeting the performance requirements for each quality characteristic shown in Table 1.

Table 1 – Coating Performance Requirements		
Quality Characteristics	ASTM Test Method	Performance Requirements
Adhesion	D3359 – Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B117, D714 & D1654	Corrosion Resistance over 3,500 hours (Scribed per D1654; failure mode is accumulation of 1/8" coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact Resistance over 60 inch lb. (Forward impact using 0.625" ball).
Weathering Resistance	D822 D2244, D523 (60° Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

2.03 ACCESSORIES

- A. CONTROLLER: provide AC Heavy-Duty Industrial Slide Gate Operator, Model SL595 by LiftMaster. gates to be operated via remote push button. Provide 20 remote push buttons.

PART 3 - EXECUTION

3.01 PREPARATION

- A. All new gate installation shall be laid out by the Fencing Contractor in accordance with the construction plans.
- B. All hardware shall be installed in accordance with the Transport installation instructions. Transport cantilever gates shall be installed so they comply with current ASTM F2200 & UL325 standards.
- C. Gate stops shall be installed on each track in a way that conforms to current ASTM F2200 standards.

3.02 INSTALLATION

- A. Gate post shall be spaced according to specified gate elevation. Posts shall be set in concrete footers having a minimum depth of 48" with a minimum diameter of 12" (Note: In some cases, local restrictions of freezing weather conditions may require a greater depth). The "Earthwork" and "Concrete" sections of this specification shall govern material requirements for the concrete footer. Posts setting by other methods such as plated posts or grouted core-drilled footers are permissible only if shown by engineering analysis to be sufficient in strength for the intended application.

3.03 CLEANING

- A. The contractor shall clean the jobsite of excess materials.

END OF SECTION 02836

SECTION 02925 - CLEANUP AND RESTORATION

PART 1 - GENERAL

- A. The Contractor shall restore areas disturbed by construction activities to a condition reasonably close to their condition before the project, unless shown otherwise on the plans. Restoration work should be performed as soon as possible after construction work is completed in a particular area.

Upon the completion of work in an area, all excess materials, debris, equipment, and similar items shall be removed from the project area by the Contractor, and disposed of properly.

PART 2 - MATERIALS

Not Applicable.

PART 3 - EXECUTION

3.01 Restoration

- A. Unless otherwise provided; aggregate surfaces, bituminous pavements, and concrete pavements shall be restored by construction of similar replacement surfaces. Aggregate surfaces shall be replaced with the materials and thicknesses of similar replacement materials. Bituminous pavement shall be replaced with the cross sections(s) shown on the plans and in accordance with the specification for bituminous paving. Concrete pavement shall be replaced with pavement in accordance with the specification for Concrete Pavement.
- B. Turf areas shall be restored by re-establishing the turf as described in the specification for Landscape work. All areas disturbed by construction that are not to be surfaced with aggregate or pavement shall be restored with turf, unless otherwise directed.

- C. Mailboxes, fences, signs, ornaments, and similar items shall be replaced at the completion of construction. Posts shall be installed plumb. Items that are lost or stolen shall be repaired or replaced at the Contractor's expense. Repairs or replacements shall meet the Owner's approval.

3.02 Temporary Restoration of Driving Surfaces

- A. Where a pavement or gravel surface is removed as a result of construction activities, a temporary surface shall be provided and maintained by the Contractor until the permanent surface is provided. Unless otherwise directed, the temporary surface shall be twelve inches of aggregate compacted to at least 95 percent of its maximum density (ASTM D1557) and graded to meet the adjacent, remaining surfaces. Aggregate shall meet the requirements of Series 23A as described in the 2012 Michigan Department of Transportation Specifications.
- B. The Contractor shall regrade the temporary surface and add additional aggregate at intervals necessary to maintain them in a relatively smooth condition.

END OF SECTION

SECTION 03001 - CONCRETE

PART 1. GENERAL

1.01 RELATED DOCUMENTS

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this specification.

1.02 SECTION INCLUDES

- A. Work included in this section includes furnishing all labor, materials, equipment and incidentals required for complete installation of formwork, reinforcement, accessories, cast-in-place concrete, finishing and curing. This section pertains to building concrete work.
- B. Related work specified elsewhere:
 - 1. Section 02300 - Earthwork
 - 2. Section 05500 - Metal Fabrications

1.03 SUBMITTALS

- A. Comply with ACI 315 "Details and Detailing of Concrete Reinforcement". Indicate reinforcement sizes, spacings, locations, and quantities, bending and cutting schedules, supporting and spacing devices.
- B. See Structural and/or Architectural drawings for General Notes and Special Conditions.
- C. Provide data on joint devices, attachment accessories, mix design for each type concrete, proportions of all ingredients, admixtures, slump range, expected strength and water cement ratio. Provide historical test data with each proposed mix design.

1.04 QUALITY ASSURANCES

- A. Building Code Requirements for Structural Concrete (ACI 318) and latest supplements thereto.
- B. Standard Practice for Selecting Proportions for Normal, Heavy Weight, and Mass Concrete (ACI 211.1).
- C. Hot Weather Concreting (ACI-305R).
- D. Cold Weather Concreting (ACI-306R).

- E. Guide for Measuring, Mixing, Transporting and Placing Concrete (ACI 304R).
- F. Guide to Curing Concrete (ACI 308R).
- G. Specifications for Structural Concrete (ACI 301).
- H. Guide for Concrete Floor and Slab Construction (ACI 302.1R).
- I. Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete (ASTM C618).
- J. Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type) - (ASTM D994).
- K. Guide to Formwork for Concrete (ACI 347).
- L. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice.
- M. Design and workmanship of all concrete shall be in accordance with referenced specifications and code listed above. Quality, tolerances, and level of performance of work shall be as specified therein. Contractor shall keep on file, in project office, current copies of all references listed above.

PART 2. PRODUCTS

2.01 FORM MATERIALS

- A. Form Material for Exposed Concrete: Plywood; 5/8" APA B-B plyform Class 1, exterior. Use plywood thickness sufficient to support concrete at temperature and rate of pour. Use only sound, undamaged sheets with clean, true edges. Furnish in largest sizes to minimize joints.
- B. Form Material for Unexposed Concrete: Plywood; 5/8" APA B-B-G-2, exposure 1, exterior, plywood graded per PS-1 standards for construction and industrial plywood. Use plywood thickness sufficient to support concrete at temperature and rate of pour. Use only sound, undamaged sheets with clean, true edges. Lumber shall be standard grade or better.
- C. In lieu of "A" above, the material specified under "B" may be used for exposed concrete if a 3/16" smooth one side, treated, pressed fiberboard liner is utilized.

- D. Lumber for light framing (less than 6" wide): standard grade and species. Framing (6" wider and from 2" to 4" thick): provide No. 1 grade in one of the following species:
1. Douglas Fir (WWPA).
 2. Southern Pine (SPIB).
 3. Redwood (RIS).
- E. Prefabricated steel or metal shall be minimum 16 ga. as approved to produce surfaces equal to those specified for wood. Forms shall be matched, tight fitting, and stiffened to support weight of concrete.
- F. Metal Form Deck: Utilized to support exterior slabs; shall be S.D.I. approved and equal to Vulcraft. Spacing of slab reinforcing shall be adjusted if required to match corrugations of metal deck.
- G. Form Ties: Bolt and rod type so designed that upon removal of the form no metal shall be within 1-1/2" of the concrete surface and no holes larger than 1" in diameter. Concrete exposed to the exterior shall utilize galvanized ties.
- H. Waterstops
1. Expansion joints: Purpose made polyvinyl chloride (PVC) or rubber profile and size as indicated on drawings or as required by field conditions, maximum possible lengths as manufactured by Williams, Greenstreak or approved.
 2. Construction joints: Inorganic clay material manufactured from Wyoming type, high swelling bentonite as indicated on drawings as manufactured by American Colloid Company or approved.
- I. Dovetail Anchor Slots: Galvanized steel, foam filled, release tape sealed slots, bond tab anchors as manufactured by Heckmann, Hohmann & Barnard, Inc. or approved.
- J. Form Release Agent: Colorless mineral oil which will not stain the concrete or impair natural bonding characteristics of coating intended for use on concrete.
- K. Formed Construction Joints for Slab-on-Grade: Galvanized steel, tongue and groove type profile with knockout holes to receive doweling, min. 26 gage unless noted otherwise.

Size and profile as indicated on drawings or as required to fit field conditions.

- L. Slab Edge Joint Filler: ASTM D994, premolded asphaltic board, thickness as indicated or (if not indicated, 1/2" thick minimum).
- M. Vapor Barrier: Conforming to ASTM E1745 Class A, non-woven, .01 permeance, not less than 15 mils thick.
 - 1. Acceptable Manufacturers:
 - a. Stego wrap 15 mil vapor barrier by Stego Industries.
 - b. WR Meadows Perminator 15 mil.
 - c. Zero-perm by Alumiseal.
 - d. Vaporblock VB15 by Raven Industries.
- N. 6 mil thick, clear polyethylene film (for bond break between walls and floor), type recommended for below grade application.
- N. Nails, spikes, lag bolts, through bolts, anchorages: Size as required, of sufficient strength and character to maintain formwork in place while placing concrete.

2.02 REINFORCEMENT MATERIALS

- A. Reinforcing Bars: ASTM A 615 Grade 60 deformed.
- B. Welded Wire Fabric: ASTM A 185, welded steel wire fabric.
- C. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.
 - 1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
 - 2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).
- D. Inert fiber reinforcement: Polypropylene fiber meeting ASTM-C1116; Fibermesh, Forta Corporation, or other

Architect approved U.L. Listed. Add to plant mixed concrete at a rate of 1.5 lbs. per cubic yard of mix.

2.03 CONCRETE MATERIALS

- A. Cement; controlling specification for Portland Cement, ASTM C150, Type I-Normal or Type II.
- B. Aggregates shall conform to ASTM C-33. Maximum size of aggregate shall not be larger than 1/5 of narrowest dimension between forms of member for which concrete is to be used, nor larger than 3/4 of minimum clear spacing between reinforcing bars, nor larger than 1/3 of slab depth.
- C. Lightweight aggregates shall conform to ASTM C 330.
- D. Water: Clean and potable.
- E. Air Entrainment Admixture: ASTM C260, as manufactured by Master Builders, Euclid, or W.R. Grace.
- F. Chemical Admixtures: ASTM C494; Type 'A' - water reducing; Type 'B' - retarding, Type 'C' - accelerating, Type 'D' - water reducing and retarding, Type 'E' - water reducing and accelerating, Type 'F' - water reducing high range; Type 'G' - water reducing high range and retarding. Calcium chloride or admixtures containing more than .05 percent chloride ions by weight of admixture shall not be used. Each admixture shall not contribute more than 5 ppm by weight, of chloride ions to the total concrete constituent. Use admixtures in strict compliance with manufacturer's directions.
- G. Fly Ash: ASTM C618, Type 'C' or 'F'.
- H. Bonding Agent: Refer to Spec Section 03300 "Bonding Agents for Concrete".
- I. Non-Shrink Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents. Capable of developing a minimum compressive strength of 7000 psi at 28 days.
 - a. Manufacturer: Dayton Superior Corp. or equal as approved by engineer.
- J. For Stamped and Colored Concrete Areas: Color Pigment to be ASTM C979, synthetic mineral-oxide pigments or colored

water reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

1. Manufacturers:

- a. Bayer Corporation
- b. ChemMasters
- c. Conspec Marketing & Manufacturing Co., Inc.; a Dayton Superior Company
- d. Davis colors
- e. Elementis Pigments Inc.
- f. Hoover Color Corporation
- g. Lambert Corporation
- h. Scofield, L.M. Company
- i. Solomon Colors

2. Color and stamp pattern: As selected by Architect from manufacturers full range. Contractor to provide an allowance of \$100/CYD in addition to his base bid to use for the stamped and colored concrete color and pattern (TBD).

K. Adhesive Anchoring: Injectable adhesive or self-contained capsule as manufactured by:

1. 'Hilti' HIT System, or Architect approved/reviewed equal.

2.04 CURING COMPOUNDS & SEALERS

A. Curing Compound/Sealer: Liquid curing compound, water base, concrete curing-sealing compound, VOC (volatile organic content) compliant, containing fugitive dye that does not leave residue (resin, varnish, wax, etc.). Fugitive dye must disappear in 7 days, as manufactured by:

1. Sonneborn Building Products, Kure-N-Seal W.
2. Dayton Superior Corporation, Safe Cure & Seal (J-18).
3. Burke by EDOCO Spartan-Cote WB Cure Seal Hardener.
4. MasterKure 100W, Master Builders, Inc.
5. Vocomp-20, W.R. Meadows.

B. Absorptive Mats: Burlap cloth, commercial quality suitable for purpose. Constructed of jute or kenaf, weighing approximately 9 oz. per square yard, complying with AASHTO M182, Class 2.

- C. Moisture retaining cover, complying with ASTM C171; one of the following: waterproof paper, polyethylene film, or polyethylene coated burlap.
- D. Crack Repair Material: Floor slabs - 2 part, 100% solid epoxy adhesive in formulation recommended by manufacturer for application, as manufactured by:
 - 1. W.R. Meadows Reziweld 1000 or Architect approved/reviewed equal.
- E. Cure/Sealer Interior Exposed Concrete Floors: Curing compound, non-residual or dissipating resin curing compound. Product of sealer manufacturer and meeting sealer manufacturer's requirements. Manufacturers to include:
 - 1. Dayton Superior Corp "Day-Chem Sil-Cure" (J-13).
 - 2. L & M Cure or Cure R.

2.05 CONCRETE MIX

- A. Mix concrete in accordance with ACI 304 and deliver concrete in accordance with ASTM C94.
- B. Quality working stresses for the design of this project shall be based on specific minimum 28-day compressive strength of concrete or on specified minimum compressive strength at earlier age at which concrete may be expected to receive full load. Provide concrete of the following properties:
 - 1. Exterior concrete; i.e. entry slabs, ramps, etc. - 4,000 psi. 28-day compressive strength; water-cement ratio, 0.40 maximum (air entrained).
 - 2. Interior slab on ground - 4000 psi. 28-day compressive strength; water-cement ratio, 0.44 maximum (non-air entrained).
 - 3. Footings, walls, supported slabs and all other concrete - 3500 psi. 28-day compressive strength; water-cement ratio, 0.51 maximum (non-air-entrained), 0.46 maximum (air entrained).
- C. Slump Limits: Proportion and design mixes to result in concrete slump at the point of placement as follows:
 - 1. Ramps and Sloping Surfaces: Not more than 3".
 - 2. Reinforced Foundation Systems: Not less than 1" and not more than 4".

3. All Other Concrete: Not less than 1" & not more than 4".
 4. Concrete containing high-range water-reducing admixture (superplasticizer). Not more than 8 inches after adding admixture to site-verified 2-3 inch slump concrete.
 5. Site added water to increase slump is strictly prohibited.
- D. Proportions of aggregate to cement shall be such as to produce a mixture which will work readily into corners, angles of forms, and around reinforcement without permitting materials to segregate. Excess free water shall not collect on concrete surface.
- E. Fly ash shall not exceed 25% of cement content by weight. No fly ash shall be used in slabs.
- F. Select admixture proportions for normal weight concrete in accordance with ACI 301, Method 1 and in strict accordance with manufacturer's instructions.
- G. Air Entraining Agent: Use in all exterior concrete exposed to weather; i.e. exposed foundation walls, supported slabs, ramps, etc. Air entrainment shall be accomplished by use of approved additives used in accordance with manufacturer's instructions. Limit air to 4% minimum to 7% maximum.
- H. Adjustment to concrete mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather or other circumstances warrant, as accepted by the Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in work.

PART 3. EXECUTION

3.01 FORMWORK ERECTION

- A. Erect formwork, shoring and bracing to achieve design requirements. Fabricate forms for easy removal without hammering or prying against exposed concrete surfaces.
- B. Provide bracing to ensure stability of formwork.
- C. Apply form release agent to formwork in accordance with manufacturer's instructions, prior to placing for accessories and reinforcement.

- D. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are affected by agent.
- E. Clean forms as erection proceeds, to remove foreign matter.
- F. Footings and foundations shall be formed, notched and/or sleeved as indicated to provide for installation of mechanical, electrical or plumbing piping/conduit.
- G. Forms shall conform to shape, lines and dimensions of members as called for, substantially and sufficiently tight to prevent leakage of concrete.
- H. Forms shall be properly braced, and tied together so as to maintain position and shape. Forms for exposed concrete shall be braced so as to provide dimensions called for, and have taped joints.
- I. Construction joints, whether indicated on drawings or not, shall be made or located so as to least impair strength of the structure. Where joint is to be made, the surface of the concrete shall be thoroughly cleaned and all latency removed. In addition, vertical joints shall be keyed.

3.02 INSERTS, EMBEDDED COMPONENTS, AND OPENINGS

- A. Provide formed openings where required for work to be embedded in and passing through concrete members.
- B. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors and other inserts.
- C. Install concrete accessories straight, level, and plumb.

3.03 REINFORCEMENT PLACEMENT

- A. Place reinforcement, supported and secured against displacement.
- B. Ensure reinforcing is clean, free of loose scale, dirt, or other foreign coatings.
- C. Provide for continuity of reinforcing around corners in footings and walls. Lap corner bars 30 bar diameters.

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

3.04 PLACING CONCRETE

- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Apply bonding agent in accordance with manufacturer's instructions.
- B. Install vapor barrier under interior slab-on-grade.
 - 1. Installation shall be in accordance with manufacturer's instructions and ASTM E164 3-98.
 - a. Unroll vapor barrier with the longest dimension parallel with the direction of the pour.
 - b. Lap vapor barrier over footings and seal to foundation walls.
 - c. Overlap joints 6 inches and seal with manufacturers tape.
 - d. Seal all penetrations (including pipes) per manufacturers instruction.
 - e. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
 - f. Repair damaged areas by cutting patches of vapor barrier material overlapping the damaged area 6 inches and taping all four sides with tape.
- C. Separate exterior slabs-on-grade from vertical surfaces with ½ inch thick joint filler, extended full thickness of slab. Also, provide filler strips at supported slabs and vertical surfaces. At interior slabs-on-grade locations, provide bond break from vertical surfaces consisting of 6 mil polyethylene film or 15# asphalt building paper and where indicated on plans.
- D. Place concrete continuously between predetermined control and construction joints. Do not break or interrupt successive pours such that cold joints occur. Where applicable, construction joints shall occur at control joint locations, unless noted otherwise.
- E. Concrete slabs on grade shall be constructed of thickness indicated. If thickness is not indicated, provide a minimum thickness of 4". Minimum thickness at pipes embedded in concrete shall not be less than three times

o.d. of the pipe. All buried piping shall have been tested before placement of concrete.

- F. Provide interior control joints where called for on drawing as detailed. When interior construction joints occur, they shall also be considered as control joints. Provide sawed groove similar to a control joint at all construction joints.
- G. Concrete shall be conveyed from the mixer to place of final deposit by methods which will prevent separation and loss of material.
- H. All equipment used for transporting equipment shall be cleaned of all debris. Ice shall be removed from all places to be occupied by concrete forms, and masonry fillers shall be thoroughly wetted except where air temperatures are below 40 degrees F.
- I. Equipment for chuting, pumping, pneumatically conveying concrete, shall be such size and design as to insure practically continuous flow of concrete at delivery and without separation of materials.
- J. Concrete shall be deposited as soon as practicable in its final position to avoid segregation due to re-handling, flowing. Concreting shall be carried on at such rate that concrete is at all times plastic and flow readily into space between bars. No concrete that has partially hardened or has been contaminated by foreign materials shall be deposited on work, nor shall re-tempered concrete be used.
- K. Concreting, once started, shall be carried on as a continuous operation until placing of panel or section is completed. Top surface shall be generally level.
- L. All concrete shall be thoroughly compacted by suitable means during operation of placing and shall be thoroughly worked around reinforcement, embedded fixtures, and into corners of forms. Vibrator shall not be used to flow concrete.
- M. Where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack with non-shrink grout or chemical adhesive. Follow manufacturer's recommendations for installation.

- N. Screed floors slabs-on-grade and concrete base for toppings level, maintaining surface flatness of maximum 1/8 inch in 10 ft.
 - O. Construct all concrete site work items to shape, size, thickness and elevations shown. Concrete supported slabs shall be 4" thick on 1" form deck with reinforcing as indicated, unless otherwise shown. Side form all work. Slope surfaces of supported slabs, 1/4" per foot to low side or as directed by Architect/Engineer.
 - P. Provide 1/2" bituminous expansion joint filler along all joints where supported slabs abut other walks, building walls, etc.
 - Q. Protecting and sealing: Protect concrete supported slabs, ramps, platforms, slabs, etc., from pedestrian traffic for three days after pouring. Concrete shall be cured using two layers of burlap kept wet for minimum of 5 days; or at Contractor's option, he may use sprayed-on compound according to manufacturer's recommendations as approved by Architect. Curing method used shall not discolor original color of concrete, nor shall white liquid curing compound be used.
 - R. Provide concrete pads, bases, foundations, etc., as indicated and/or required by mechanical, electrical or other equipment supplier. Set anchor bolts for machine and equipment to templates or measurements provided.
- 3.05 FORM REMOVAL
- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
 - B. Remove formwork progressively and in accordance with code requirements.
- 3.06 FLOOR FINISHING
- A. Finish concrete floor surfaces in accordance with ACI 301 and ACI 302.
 - B. Uniformly spread, screed, and float concrete.
 - C. Steel trowel surfaces which will be left exposed.
 - D. In areas with a floor drain, maintain floor level at walls and pitch surfaces uniformly to drains.

- E. Floor shall be finished without excessive floating. Delay troweling until concrete is sufficiently hard to prevent water working to surface. Bring finish to smooth level surface with minimum troweling possible.
- F. Finishes, other than floors, exposed on exterior or interior shall be formed true, free from marks, irregularities. Remove any loose material, grind all projections, fill any honeycombing or holes, finish smooth. Use carborundum stone to hand rub and provide smooth, even surface where directed.
- G. Thoroughly clean and prepare concrete floors scheduled to receive a sealer. Apply in strict accordance with manufacturer's instructions.

3.07 CURING

- A. Place absorptive matting and dampen as required.
- B. Immediately after placement, protect concrete from premature drying.
- C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- D. Provisions shall be made for maintaining concrete in moist condition for at least 5 days after placement, except high early concrete which shall be cured for at least 2 days.
- E. Cold Weather Requirements:
 - 1. General: Except as modified herein, all work shall be in accordance with ACI 306R.
 - 2. Adequate equipment shall be provided for heating concrete materials and protecting concrete during freezing or near freezing weather. No frozen materials or materials containing ice shall be used.
 - 3. All concrete materials, all reinforcement, forms, fillers, ground with which concrete is to come in contact shall be free from frost. Whenever temperature of surrounding air is below 40° F., all concrete placed in forms shall have a temperature of between 70° F., 80°F. Adequate means shall be provided for maintaining temperature of not less than 70° F. for 3 days, 50° F. for 5 days, except high-early concrete shall have temperature maintained at not less than 70° F. for 2 days, 50° F. for 3 days,

or for as much more time as necessary to insure proper curing. Housing, covering, other protection used in connection with curing shall remain in place at least 24 hours after artificial heating is discontinued. No dependence shall be placed on salt or other chemicals for prevention of freezing.

F. Weather Conditions:

1. In hot weather, sprinkle and cover all concrete for at least 24 hours longer than specified for normal curing periods. In hot weather work shall be in accordance with ACI 305R.
2. In weather when temperature falls below freezing, and in any event between December 1 and April 1, no concrete shall be poured without adequate frost protection.

3.08 CONCRETE FINISHING

- A. Provide concrete surfaces to be left exposed, concrete walls, columns, etc., with smooth rubbed finish not later than one day after form removal.
1. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 2. Provide $\frac{3}{4}$ " x $\frac{3}{4}$ " beveled edges at corners of exposed concrete.

3.09 FIELD QUALITY CONTROL

- A. Inspection and testing shall be performed by an independent firm selected by the Owner and retained by the Contractor, in accordance with Division 1, Section 01400 "Quality Control".
- B. The Contractor shall notify the Architect/Engineer and the Testing Lab at least five (5) days prior to the commencement of concrete operations.
- C. See Division 1 for inspection and testing allowances, Section 01400 "Quality Control".
- D. Specimens shall be molded and cured as per ASTM C31. Three specimens per test, not less than one test for each day's pour, each 50 yards concrete poured, each building

unit, or each strength concrete. Specimens shall be laboratory cured.

- E. Specimens shall be tested in accordance with ASTM C39. One specimen shall be tested at 7 days, two at 28 days.
- F. When average strength of laboratory control cylinders fall below required compressive strength, Architect shall have right to order change in proportions and water content for remainder of structure. Architect shall have right to require tests as per ACI Building Code; Chapter 20 where load tests show concrete does not conform with drawings or specifications. Deficiency shall be corrected without additional cost to Owner.
- G. Four copies of test reports at 7 days, 28 days, shall be sent directly to the Architect by the Testing Laboratory, with all required information shown.
- H. Slump tests per ASTM C-172 and C-143, minimum of one test for each set of cylinders, or more as conditions warrant. Deliveries exceeding specified slump shall be rejected.

3.10 DEFECTIVE CONCRETE

- A. Modify or replace concrete not conforming to required lines, details and elevations, as directed by the Architect/Engineer.
- B. Failure of concrete topping to bond to substrate (as evidenced by a hollow sound when tapped), or disintegration or other failure of topping to perform as a floor finish, will be considered failure of materials and workmanship. Repair or replace toppings in areas of such failures, as directed.

END OF SECTION 03001

SECTION 04100 - MORTAR & GROUT

PART 1. GENERAL

1.01 RELATED DOCUMENTS

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this specification. Refer to Structural Drawings for additional information.

1.02 SECTION INCLUDES

- A. Work included in this section consists of furnishing all labor, materials, equipment, and incidentals required for complete installation of mortar and grout for masonry.
- B. Related work specified elsewhere:
 - 1. Section 03001 Concrete (Non-shrink grout).

1.03 ENVIRONMENTAL REQUIREMENTS

- A. Recommended Practices for Hot and Cold Weather Masonry Construction as published by the Masonry Industry Council.

PART 2. PRODUCTS

2.01 MATERIALS

- A. Portland Cement: ASTM C150, Type 1 provide natural color or white cement as required to provide mortar color indicated.
- B. Mortar Aggregate: ASTM C144, standard masonry type.
- C. Hydrated Lime: ASTM C207, Type 'S', or 'N'.
- D. Masonry Cement: ASTM C91.
- E. Premix Mortar: ASTM C387.
- F. Grout Aggregate: ASTM C404.
- G. Grout Fine Aggregate: ASTM C144, 100% passing #8 sieve, maximum 5-30% passing #50 sieve.
- H. Water: Clean and potable.
- I. Integral water repellent additive meeting ASTM E-514.

J. Plasticizer:

1. SIKA Chemical Corporation "Intraplast Z".
2. Euclid Chemical Co. "Eucon BK-S".

K. Storage of all material shall prevent the intrusion of foreign matter. Store all masonry units on the ground, protected against damage and intrusion of excess moisture. No damaged or deteriorated materials shall be used.

2.02 MORTAR MIXES

A. Mortar for exterior load bearing walls and all exterior masonry work below grade; ASTM C270, Type 'M' or 'S', using the property method unless noted otherwise on structural drawings. Use ASTM C270 Type 'N' above grade at exterior veneers.

B. Mortar for interior non-load bearing walls and partitions: ASTM C270, Type 'M' or 'S', using the property method.

C. Mortar for reinforced masonry ASTM C270, Type 'S', using the property method.

D. Pointing mortar for masonry veneers ASTM C270, Type 'N', using the property method.

E. Mortar Pigments: Natural and synthetic milled, blended iron oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.

1. Provide colored mortar pigments: Color shall be as selected by Architect from SGS concentrated A, H and X Series mortar colors as manufactured by Solomon Colors, Springfield, IL 800-624-0261.
 - a. Carbon added for darker colors shall not exceed 4%.
 - b. Mix shall product uniform and consistent color.
 - c. Inert, stable to atmospheric conditions, sun fast, weather resistant, alkali resistant, water insoluble, lime proof and non bleeding.
 - d. Free of deleterious fillers and extenders.
 - e. Practice size: 95 to 99% minus 325 mesh.
 - f. pH: 6.5 to 9.0.
 - g. Shall be tested per ASTM C91 and ASTM C270. Exceed 1800 psi at 28 days strength requirement.

- F. Ready-Mixed Mortar: Cementitious materials, water, and aggregate complying with requirements specified in this Article; combined with set-controlling admixtures to produce a ready-mixed mortar complying with ASTM C 1142.
- G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by the manufacturer for use in masonry mortar of composition indicated.

2.03 MORTAR MIXING

- A. Thoroughly mix mortar ingredients in approved type mixing machine in quantities needed for immediate use in accordance with ASTM C270 or C780. Discharge mixer completely before recharging.
- B. All exterior above grade mortar exposed to moisture shall be fabricated with integral water repellent additive.
- C. Blend admixtures in accordance with manufacturer's instructions.
- D. Do not use anti-freeze compounds to lower the freezing point of mortar.

2.04 GROUT MIXES

- A. Bond beams, lintels, engineered masonry, reinforced masonry walls: min. 3000 psi strength at 28 days unless noted otherwise; 8-10 inches slump; pre-mixed grout in accordance with ASTM C94, or batch mixed in accordance with ASTM C476 for fine or course grout.

PART 3. EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Apply bonding agent to existing concrete surfaces.

3.02 INSTALLATION

- A. Install pre-mix mortar and grout in accordance with manufacturer's instructions.

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- B. Work grout into masonry cores and cavities to eliminate voids. Do not displace reinforcement. Reinforcing shall be mechanically anchored in masonry cores to prevent displacement during grouting.

END OF SECTION 04100

SECTION 04300 - UNIT MASONRY

PART 1. GENERAL

1.01 RELATED DOCUMENTS

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this specification.

1.02 SECTION INCLUDES

- A. Work included in this section consists of furnishing all labor, materials, equipment and incidentals required for complete installation of concrete masonry and brick units including installation of reinforcement, anchorage and accessories. Refer to Structural Drawings for additional information.

- B. Related work specified elsewhere:

1. Section 04100 - Mortar & grout.
2. Section 04720 - Cast Stone
3. Section 07175 - Water Repellant Coatings
4. Section 07200 - Building Insulation
5. Section 07920 - Sealants & Caulking

1.03 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops the following installed compressive strengths (f'm) at 28 days.

1. For concrete Unit Masonry: As follows, based on net area:
 - a. f'm = 1900 psi (13.05 MPa).
2. For Brick Unit Masonry: As follows, based on gross area:
 - a. f'm = 1500 psi (10.3 MPa).

1.04 SUBMITTALS

- A. Provide data on concrete masonry units.
- B. Reinforcing steel shop drawings (refer to Structural Drawings for additional information).
- C. Shop drawing for cast stone trim including cutting and setting diagrams.

- D. If specifically requested by the Architect/Engineer, provide samples for verification as follows.
1. Full-size units for each different exposed masonry unit required showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.
 2. Stone trim samples not less than 12 inches (300 mm) in length showing the full range of colors and textures expected in the finished construction.
 3. Weep holes/vents in color to match mortar color.
 4. Accessories embedded in the masonry.

1.05 QUALITY ASSURANCE

- A. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.
- B. Single-Source Responsibility for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one source and by a single manufacturer for each different product required.
- C. Single-Source Responsibility for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Hot and Cold weather requirements: Recommended Practices for Hot or Cold Weather Masonry Construction as published by the Masonry Industry Council.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not install until they are in an air-dried condition.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location.

- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

PART 2. PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. Concrete block (CMU): ASTM C90, medium weight (105-125 pcf). Use for above and below grade, exterior or interior wall applications. Provide units made with "dry block" as manufactured by W. R. Grace & Company (or approved) for exterior wall applications. This includes exterior walls with veneers.
 - 1. Texture of exposed faces of block shall be uniform for all block used in this project. Solid units may be used for bearing under structural members. No units with exposed chipped surfaces will be permitted in areas where exposed.
 - 2. Provide shapes such as special units at pilaster blocks, bullnose all external corners, sash recesses, square ends, lintel blocks and other, as required by drawings or specifications.
- B. Split face Masonry Units with Krete
 - 1. Standards: 4" Units shall be normal weight block, withstanding compression test loads of at least 3,000 p.s.i. for individual units, or 3,500 p.s.i. for an average of five units, basing load figures on the average net area of the blocks. Units shall meet or exceed requirements specified for Type I, ASTM C55-97A.
 - 2. Manufacturer: Units specified herein are based on those manufactured by Grand Blanc Cement Products, Inc. Grand Blanc, Michigan, Phone: 1-800-875-7500. The same manufacturer shall produce all visually related block.
 - 3. Finish: Splitface units are to be selected from colors using natural dense aggregates including those with white cement/white aggregate. Cost of split face units to be based on manufacturers full color range. Samples shall be submitted for establishing an approved range of color variation and texture. Multiple colors will be chosen.
 - 4. Shape: Splitface Block shall conform to Grand Blanc

Cement Products series full face split, Standard pattern as detailed.

C. Stone Units:

1. Stone, 4'' exterior veneer units for buildings shall be: Halquist Chilton SF/WE color. See elevations for ht. of stone veneer.
2. Stacked Stone for interior Fireplace wall in Reading Room A102 shall be: Realstone Systems, Shadowstone in color ``Sierra''.
3. Contact: Andy Halsted, Glen-Gery Michigan Masonry Supply, 6315 Highland Road, Waterofrd, Mi. 48327, 248-756-0447.

2.02 BRICK UNITS

A. Face Brick: ASTM C216, Type FBX or Type FBS, Grade SW.

B. Brick Masonry Units:

1. Contractor shall provide the following brick as follows:
 - a. Field Brick: Glen Gery,
Chicago Collection
Navajo Red Velour
2. Contact: Andy Halsted, Glen-Gery Michigan Masonry Supply, 6315 Highland Road, Waterofrd, Mi. 48327, 248-756-0447.

2.03 REINFORCEMENT AND ANCHORAGE

- A. All single wythe joint reinforcement shall be ladder type wire reinforcing consisting of No. 9 gauge deformed side rods, with No. 9 gauge standard ladder type cross rods. All rods shall be mill galvanized using ASTM A153, Class B-2 standards. Out to out spacing of side rods shall be approximately 2" less than the nominal wall thickness. Provide pre-fabricated corners and tee units as required.
- B. All multiple wythe/cavity wall joint reinforcement shall be adjustable ladder type mill galvanized in accordance with ASTM A153, Class B-2 standards. Separate adjustable ties extend to engage outer wythe by at least 2'' and spaced not more than 16'' o.c.
 1. Use where horizontal joints of facing wythe do not align with those of back-up and where indicated.

2. Use where facing wythe is of different material than back-up wythe.
- C. For anchorage to steel framing, provide manufacturer's standard anchors with crimped 1/4 inch (6.4 mm) diameter wire anchor section for welding to steel and triangular-shaped wire tie section sized to extend within 1 inch (25 mm) of masonry face and wire diameter of 0.25". Provide one tie on each side of framing where masonry abuts. Ties to be spaced at 16" o.c. vertical
- D. Adjustable Steel Wire Wall Ties (For Veneer w/CMU Backup): Formed wire 3/16" diameter high tensile, cold drawn steel wire conforming to ASTM A82, galvanized zinc coated finish, installed at 16" o.c. vertical opposite ladder reinforcing. Provide one tie per 2.66 square feet of wall area minimum.
- E. Manufacturers:
 1. AA Wire Products Co.
 2. Dur-O-Wal.
 3. National Wire.
 4. Hohmann and Barnard, Inc.
 5. Wire Bond
 6. Other Architect Approved.
- F. Reinforcing Steel: ASTM A615, 60-ksi-yield grade deformed steel bars unprotected finish.

2.04 FLASHINGS

- A. Through-Wall Flashings: Rubberized asphalt sheet membrane dampproof coursing/wall flashing material, 40 mil thick as manufactured by W.R. Grace & Company "Perm-A-Barrier", including bituthene mastic for sealing joints, terminations and penetrations.

2.05 ACCESSORIES

- A. Building Paper: 15# asphalt saturated felt.
- B. Column Wrap: Waxed corrugated cardboard or 15# asphalt saturated felt.
- C. Masonry Waterproofing: Clear, penetrating coating. Refer to Specification Section 07175 "Water Repellant Coatings".

- D. Cavity Wall Insulation: Polystyrene insulation. Refer to Section 07200.
- E. Weep Vents: Plastic Weep Vent: One-piece, flexible extrusion manufactured from ultraviolet-resistant polypropylene copolymer, designed to weep moisture in masonry cavity to exterior, sized to fill head joints with outside face held back 1/8 inch from exterior face of masonry, in color selected from manufacturer's standard.
- F. Cavity Drainage Material: 1-inch (25 mm) thick, reticulated, nonabsorbent mesh, made from polyethylene strands and shaped to maintain drainage at weep holes without being clogged by mortar droppings.
 - 1. Product: Subject to compliance with requirements, provide "Mortar Net" by Mortar Net USA, Ltd or Architect approved.

2.06 LINTELS

- A. Lintels shall be steel, precast or cast-in-place in accordance with details as shown or scheduled on the drawings

PART 3. EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Verify that field conditions are acceptable and ready to receive work. Examine rough-in and built-in construction to verify locations prior to installation.
- B. Coordinate placement of anchors supplied to other sections.
- C. Employ skilled mechanics, experienced supervision. Lay masonry plumb, true to line, with level, accurately spaced courses. Break vertical joints unless otherwise indicated. Keep bond plumb. Rack courses, where necessary, without toothing. Lay out facing before setting, minimize cutting closures, jumping bond.

- D. Do not wet concrete masonry. Lay masonry with complete bearing in full beds of mortar. Butter sides for full vertical joints. Shove units into place. Anchor walls not otherwise bonded with ties every 8", every four (4) courses.
- E. Cover top of masonry work at end of day's work with reinforced waterproof non-staining membrane. When air temperature is below 40°F., heat masonry materials, provide cold weather protection necessary to maintain temperature from 40°F. for 48 hours, both sides of masonry.
- F. Blend brick on site in percentages as indicated to achieve specified blend and range.
- G. Mix units for exposed unit masonry from several pallets as they are placed to provide a uniform blend of colors and textures.

3.02 COURSING

- A. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness. Lay out walls in advance for accurate spacing of openings, movement type joints, returns, etc. Avoid units of less than half size at corners and jambs.
- B. Block unit shall be laid in stack or running bond, as indicated on drawings with vertical joints aligned plumb, horizontal joints level. Joints in back-up work shall be worked out to provide bonding with facing masonry. Joints shall be uniform in width, thickness not to exceed 1/3". Exposed joints in finish work shall be tooled slightly concave, others shall be cut flush.
- C. Brick Units: Lay in running, stacked, rowlock and soldier bonds where noted on drawings. Course as detailed on drawings. Form raked or concave mortar joints as detailed.
- D. Initial block course (first course above foundation) in walls (interior or exterior) shall be laid in full mortar beds on shells and cross webs; in other locations, units shall be laid in full mortar beds on shells only. Solid block units shall be laid same as brick. Vertical joints between units shall be filled with mortar between shell ends.

- E. All non-bearing walls and partitions shall terminate against beam soffits, roof, or structural ceilings, unless otherwise shown on drawings, or as stated below. Build wall to within 3/8" of overhead structure on roof, fill top joint and all voids with non-combustible insulation board which has width of 1" less than wall, then caulk joints. Provide lateral support at top of the walls as indicated.
- F. Both bearing and non-bearing masonry walls which enclose corridors, storage or mechanical rooms, shops, and other rooms requiring a rated separation from adjacent areas, must have the top joint as well as all voids at roof deck and elsewhere in or over these walls, filled with cement grout, mortar, or plaster bed of at least 2" in width. Where no ceilings occur in the room, said fill shall be troweled flush with the wall surface or surfaces on the exposed side of the wall.
- G. All interior and exterior block walls shall have control joints 20'-0" o.c. maximum for exterior and 25'-0" to 30'-0" at interior walls. Line up control joints with joints in foundation wall and joints in face brick. Leave exposed faces on joints ready for caulking. Provide vertical reinforcing in grouted core on each side of exterior masonry control joints. Reinforcing to match vertical wall steel.
- H. Bond each course at corners and break vertical joints at least 2". Tee shaped or cross shaped intersecting walls shall have vertical continuous joint. These joints shall be caulked. Provide for continuity of joint reinforcing by providing pre-fabricated "T" shaped or "L" shaped units.
- I. Provide welded steel masonry reinforcing placed in every second horizontal course in all block walls with at least one layer below a window sill level and one layer above a lintel level. Lay reinforcing on wall and cover with mortar, bed unit as usual. Longitudinal wire shall be lapped not less than 32 diameters at splices. At corners, cut inside rod and bend to proper angle.
- J. Construct bond beams as indicated with concrete grout. Maintain accurate location of reinforcing steel during grout placement.
- K. Grout course solid (or use solid units) immediately below veneer, where masonry serves as support for the veneer (i.e. brick ledges).

- L. Stopping and Resuming Work: In each course, rack back 1/2-unit length for one-half running bond or 1/3-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry and remove loose masonry units and mortar prior to laying fresh masonry.

3.03 PLACING AND BONDING

- A. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.
- B. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with fire rated compressible joint filler.

3.04 WEEPS AND VENTS

- A. Install weep holes in veneer at 24'' on center horizontally or as indicated on drawings above through-wall flashing, above shelf angles, and at bottom of walls. Weeps shall be laid with masonry. Weep holes shall not be drilled, cut or carved into mortar joints.

3.05 CAVITY WALL

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep holes. Provide layer of clean mason's sand at base of cavity directly on through wall flashing of sufficient depth to cover weep holes.
- B. Build inner wythe ahead of outer wythe to receive cavity insulation air/vapor barrier adhesive.
- C. Tie exterior wythe to back-up with continuous horizontal joint reinforcing.

3.06 REINFORCEMENT & ANCHORAGES - SINGLE WYTHE MASONRY

- A. Walls laid up with concrete block, including where used as back-up shall be reinforced with horizontal steel wall reinforcing as specified. Reinforcing shall be of proper width for block wythe, to have side wires over block shells. Place joint reinforcement at 16" o.c. vertical and continuous in first and second joint below top of walls.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum of 3'-0" beyond each side of opening.

- C. Reinforcing in foundation walls (below floor slab) shall be placed every other course, continuous.
- D. Terminate reinforcing each side of control joints; lap end joints 12", form corners by cutting and lapping inside wire, bending outside wire; form intersections by cutting and lapping reinforcing from one wall with other wall. Bed side wires completely in mortar.

3.07 REINFORCEMENT & ANCHORAGES - CAVITY WALL MASONRY

- A. Install horizontal joint reinforcement 16 inches o.c. vertically. Place joint reinforcement continuous in first joint below top of walls.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

3.08 MASONRY FLASHINGS

- A. Extend flashings under, over and through veneer. Turn up minimum 8 inches and bed into mortar joint of backup masonry.
- B. Lap end joints and seal watertight.
- C. All discontinuous flashing shall be turned up one head joint past the opening jamb to form an end dam.
- D. Use flashing manufacturer's recommended adhesive and sealer.

3.09 LINTELS

- A. Install loose steel lintels over window openings, door openings and other miscellaneous openings as indicated on the structural plans.
- B. Construct concrete block lintels over window openings, door openings and other openings as indicated on the structural plans or otherwise required.
- C. Maintain minimum bearing each side of opening of 8" or as specified on structural drawings. Align end of lintel with vertical block joints.

3.10 GROUTED COMPONENTS

- A. Reinforce bond beam and pilasters as detailed.

- B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- C. Place and consolidate grout fill without displacing reinforcing.
- D. At beam bearing locations, fill masonry cores with grout for a minimum 12 inches either side of member and three courses vertical, unless otherwise noted.

3.11 ENGINEERED MASONRY

- A. Lay masonry units with core cells vertically aligned and cavities between wythes clear of mortar and unobstructed.
- B. Reinforce masonry unit cores and cavities with reinforcement bars and grout as indicated. Provide vertical bars in corners. Provide vertical bars at each side of all masonry openings. Vertical bars to continue at noted spacing above openings.
- C. Secure vertical reinforcement in position at top and bottom of cells and at intervals not exceeding 192 bar diameters. Splice reinforcement 48 bar diameters, minimum 12".
- D. Place mortar in masonry unit bed joints back 1/4 inch from edge of unit grout spaces; bevel back and upward. Permit mortar to cure 3 days before placing grout.
- E. Grout spaces less than 2 inches in width with fine grout using low lift grouting techniques. Grout spaces 2 inches or greater in width with coarse grout using high or low lift grouting techniques.
- F. When grouting is stopped for more than one hour, terminate grout 1-1/2 inch below top of upper masonry unit to form a positive key for subsequent grout placement.
- G. Low Lift Grouting: Place first lift of grout to a height of 60 inches maximum and consolidate by mechanical vibration. Place subsequent lifts in maximum 60 inch increments and vibrate grout for consolidation. Ensure mortar has gained sufficient strength to withstand pressure prior to grouting. "Puddling" may be used in lieu of mechanical vibration if grout lifts are limited to 12 inches maximum.
- H. High Lift Grouting:

1. Provide cleanout opening no less than 4 inches high at the bottom of each cell to be grouted by cutting one face shell of masonry unit.
2. Clean out masonry cells and cavities with high-pressure water spray. Permit complete water drainage. Cells and cavities may be "cleaned" by using steel rod to remove excess mortar protrusions.
3. Request that Architect/Engineer inspect the cells. Allow three days advance notice.
4. After cleaning and cell inspection, seal openings with masonry units.
5. Pump grout into spaces. Maintain water content in grout to intended slump without aggregate segregation.
6. Limit grout lift to 60 inches and mechanically vibrate for grout consolidation. Wait 30 to 60 minutes before placing next lift.

3.12 CONTROL AND EXPANSION JOINTS

- A. Do not extend horizontal joint reinforcement through control and expansion joints.
- B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the masonry unit. Fill the resultant elliptical core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
- C. Form expansion joints as detailed.

3.13 BUILT-IN WORK

- A. As Work progresses, build in metal door and glazed frames, fabricated metal frames, window frames, wood nailing strips, anchor bolts, plates, and other items to be built in the Work furnished by other Sections.
- B. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

3.14 POINTING AND CLEANING

- A. Point up all exposed brick where required, fill all holes and joints; remove loose mortar, cut out defective joints, and repoint where necessary.

3.15 TOLERANCES

- A. Maximum Variation from Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Variation from Level Coursing: 1/8 inch in 3 ft. and 1/4 inch in 10 ft.; 1/2 inch in 30 ft.

3.16 CUTTING AND FITTING

- A. Cut and fit for chases, pipes, conduit, sleeves, grounds, and other items. Coordinate with other Sections of Work to provide correct size, shape, and location.
- B. Form slots, grooves, chases, recesses, other items required for other trades. Build in all required structural steel, miscellaneous metal, sash anchors, precast concrete anchors, other items. Bed in mortar to line and level. Build in counter flashing furnished by Roofing Contractor. Check all requirements in advance to eliminate cutting.
- C. Do necessary cutting of masonry for installation of items not otherwise provided for. Patch walls, maintain structural stability, appearance, weather resistance.
- D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting, where possible. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.17 REPAIRING, POINTING AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units; install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point-up joints, including corners, opening, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for application of sealants.
- C. Remove excess mortar and mortar smears.
- D. Clean soiled surfaces with cleaning solution.

- E. On completion of pointing and re-pointing of all face brick and block work, interior and exterior, clean thoroughly with "Sure Klean 600", "Craft Klean" (for splitface and burnished units, clean with custom masonry cleaner by Prosoco) or similar prepared detergent, applied strictly according to the manufacturer's instructions with stiff fiber brushes. Drench with clean water immediately after cleaning. Do not use job mixed acid on this project. All cleaning shall be done prior to installation of any finished floor, wall mounted light fixtures, aluminum frames or items subject to damage. Protect hollow metal frames, other built-in items.
- F. For cleaning pre-faced units, use masonry detergent cleaners in accordance with manufacturer's directions. Do not use hydrochloric acids or other unbuffered acids. Do not use steel wool or other abrasives.
- G. Waterproofing: Refer to Section 07175 "Water Repellant Coatings".

3.18 MASONRY WASTE DISPOSAL

- A. Recycling: Undamaged, excess masonry materials are Contractor's property and shall be removed from the Project site for his use.

END OF SECTION 04300

SECTION 04720 - CAST STONE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Bidding and Contract Requirements, and to General and Supplemental Conditions, hereby made a part of this Section.

1. Section includes:

- a. Custom cast stone

1.02 RELATED SECTIONS:

- A. Section 04100 - Mortar & Grout
- B. Section 04300 - Unit Masonry
- C. Section 07175 - Water Repellant Coatings
- D. Section 07910 - Joint Fillers and Gaskets
- E. Section 07920 - Sealants and Caulking

1.03 REFERENCES:

- A. ASTM A 615/A 615 M - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- B. ASTM A 767/A767M - Zinc-Coated (galvanized) Steel Bars for Concrete Reinforcement.
- C. ASTM C 33 - Concrete aggregates.
- D. ASTM C 39 - Compressive strength of concrete cylinders.
- F. ASTM C 90 - Loadbearing Concrete Masonry Units
- G. ASTM C 140 - Sampling and Testing Concrete Masonry Units and Related Units
- H. ASTM C 150 - Portland Cement
- I. ASTM C 270 - Mortar for Unit Masonry
- J. ASTM C 426 - Linear Drying Shrinkage of Concrete Masonry Units
- K. ASTM C 494 - Chemical Admixtures for Concrete

- L. ASTM C 666 - Resistance of Concrete to Rapid Freezing and Thawing
- M. ASTM C 979 - Pigments for Integrally Colored Concrete
- N. ASTM C 1194 - Compressive Strength of Architectural Cast Stone
- O. ASTM C 1195 - Absorption of Architectural Cast Stone
- P. ASTM C 1364 - Architectural Cast Stone
- Q. Cast Stone Institute Technical Manual (current ed.)

1.04 DEFINITIONS:

- A. Cast Stone: An architectural masonry unit manufactured to copy fine grain texture and color of natural cut stone.
- B. Dry Cast Concrete Products: Manufactured from zero-slump concrete.
- C. Machine Casting Method: Vibratory compaction by machine of earth-moist, zero-slump concrete against rigid mold until it is densely compacted.
- D. Vibrant Dry Hand Tamp Casting Method: Vibratory compaction by hand tamp of earth-moist, zero-slump concrete against rigid mold until it is densely compacted.

1.05 SUBMITTALS:

- A. Product Data: Submit manufacturer's Product Data
- B. Shop Drawings: Submit manufacturer's shop drawings, including profiles, cross sections, modular unit lengths, reinforcement if required, exposed faces, anchors and anchoring method recommendations if required and annotation of cast stone types and location.
- C. Samples: Submit pieces of manufacturer's cast stone units that represent general range of texture and color proposed to be furnished for project.
- D. Test Results:
 - 1. Submit manufacturer's test results from cast stone units previously made by manufacturer using materials from same sources proposed for use in project.
 - 2. Submit manufacturer's test results from plant production

testing.

E. Warranty: Submit manufacturer's standard warranty.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Sufficient plant facilities to provide quality, shapes, quantities, and sizes of cast stone units required without delaying progress of the work.
2. Minimum of 10 years experience in producing masonry units or cast stone.

1.07 DELIVERY, STORAGE AND HANDLING

A. Delivery:

1. Deliver cast stone units secured to shipping pallets and protected from damage and discoloration.
2. Provide itemized shipping list.
3. Number each piece individually, as required, to match shop drawings and schedules.

B. Storage

1. Store cast stone units and installation materials in accordance with manufacturer's instructions.
2. Store cast stone units on pallets with non-staining, waterproof covers.
3. Do not double stack pallets.
4. Ventilate units under covers to prevent condensation.
5. Prevent contact with dirt and splashing.

C. Handling:

1. Protect cast stone units, including corners and edges, during storage, handling, and installation to prevent chipping, cracking, staining, or other damage.
2. Handle long units at center and both ends simultaneously to prevent cracking.

1.08 SCHEDULING

A. Schedule and coordinate production and delivery of cast stone units with unit masonry work.

PART 2 - PRODUCTS

2.01 MANUFACTURER:

CAST STONE

04720-3

- A. RockCast, Division of Reading Rock Inc., 4600 Devitt Drive, Cincinnati, OH 45246. Toll Free (800)482-6466. Phone (513)874-2345. Fax (513)874-2520. Web Site: www.rockcast.com. E-mail: info@rockcast.com
- B. Custom Cast Stone Inc., 734 E. 169th Street, Westfield, Indiana 46074, toll free (888)776-9960 phone (317)896-1700 Fax (317)896-1701
- C. Custom Stone Works, 32910 Plymouth Road, Livonia, MI 48150 Phone:(734) 427-8158 Fax:(734) 427-8178 Toll free:(877)40-GRANITE.
- D. Or Equal as approved by Architect/Owner.

2.02 CUSTOM CAST STONE UNITS

- A. Custom Cast Stone Units; RockCast Custom Cast Stone Series or Custom stone units.
- B. Compliance: ASTM C 1364.
- C. Casting Method: Vibrant dry hand tamp.
- D. Texture: Smooth.
- E. Color: As selected by Architect/Owner from manufacturer's full selection of colors.
- F. Units: As indicated on drawings.
- G. Profiles: As indicated on drawings.
- H. Test Results:
 - 1. Compressive Strength, ASTM C 1194: Greater than 6,500 psi at 28 days.
 - 2. Absorption: ASTM C 1195: 6.0 percent max at 28 days.
 - 3. Linear Shrinkage, ASTM C 426: Less than 0.065 percent.
 - 4. Density, ASTM C 140: Greater than 120 pounds per cubic foot.
 - 5. Freeze-Thaw, ASTM C 666: Less than 4.0 percent.
- I. Curing: Cure in enclosed chamber at 95 percent relative humidity for 24 hours or yard cure for 350° days (i.e. 7 days @ 50°F or 5 days @ 70°F) prior to shipping.
- J. Cast Stone type units, as indicated on drawings.

2.03 CAST STONE MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II. White and/or gray as required to match specified color.
- B. Coarse Aggregate: ASTM C 33, except for gradation. Granite, quartz, or limestone.
- C. Fine Aggregates: ASTM C 33, except for gradation. Manufactured or natural sands.
- D. Pigments: ASTM C 979, except do not use carbon black pigments. Inorganic iron oxide pigments.
- E. Water reducing, retarding, and accelerating admixtures: ASTM C 494.
- F. Water: Potable.
- G. Reinforcing Bars: ASTM A 615, deformed steel bars. Galvanized when covered with less than 1 ½ inches of material.
 - 1. Galvanized Coating: ASTM A 767

2.04 TEXTURE AND COLOR

- A. General: Match texture and color of full-size sample on file with Architect.
- B. Texture of surfaces exposed to view:
 - 1. Fine-grained texture similar to natural stone.
 - 2. Approximately equal to approved sample when viewed in direct daylight at 20 feet.
- C. Surface Voids:
 - 1. Size: Maximum 1/32 inch.
 - 2. Density: Less than 3 occurrences per any 1 square inch.
 - 3. Viewing Conditions: Not obvious under direct daylight at 20 feet.
- D. Minor Chipping:
 - 1. Minor chipping resulting from shipping and delivery shall not be grounds for rejection of cast stone units.
 - 2. Minor chips shall not be obvious under direct daylight at 20 feet, as determined by Architect.

E. Color Variation

1. Viewing Conditions: Compare in direct daylight at 20 feet, between cast stone units of similar age, subjected to similar weathering conditions.

2.05 MORTAR

- A. Mortar: ASTM C 270, Type N, as specified in Section 04100 Mortar & Grout.

2.06 ACCESSORIES

- A. Anchors: Type 304 stainless steel.
- B. Sealant: As specified in Section 07920.
- C. Cleaner: Prosoco Sure Klean 600 Detergent, or Prosoco Sure Klean Vana Trol as required per brick type.

2.07 FABRICATIONS

- A. Shapes: Unless otherwise indicated on drawings, provide:
 1. Suitable wash on exterior sills, copings, projecting courses and units with exposed top surfaces.
 2. Drips on projecting units, wherever possible.
- B. Reinforcement: As required to withstand handling stresses.

2.08 TOLERANCES

- A. General: Manufacture cast stone units within tolerances in accordance with Cast Stone Institute Technical Manual, unless otherwise specified.
- B. Cross Section Dimensions: Do not deviate by more than plus or minus 1/8 inch from approved dimensions.
- C. Length of Units: Do not deviate by more than length/360 or plus or minus 1/8 inch, whichever is greater, not to exceed plus or minus 1/4 inch.
- D. Warp, Bow or Twist: Do not exceed length/360 or plus or minus 1/8 inch, whichever is greater.

2.09 PRODUCTION QUALITY CONTROL

- A. Mix Designs: Test new and existing mix designs for compressive strength and absorption before manufacturing cast stone units.

- B. Plant Production Testing: Test compressive strength and absorption from specimens selected at random from plant production. Obtain samples every 500 cubic feet of product produced.
 - 1. Custom Cast Stone Units: Test in accordance with ASTM C 1194 and C 1195.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine construction to receive cast stone units. Notify General Contractors if construction is not acceptable. Do not begin installation until unacceptable conditions have been corrected.
- B. Examine cast stone units before installation. Do not install unacceptable units.

3.02 INSTALLATION

- A. Install cast stone units in conjunction with masonry, as specified in Section 04300 "Unit Masonry".
- B. Pull units from multiple cubes during installation to minimize variation in color.
- C. Cut units using motor-driven masonry saws.
- D. Do not use pry bars or other equipment in a manner that could damage cast stone units.
- E. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.
- F. Set cast stone units in full bed of mortar, unless otherwise indicated on the drawings.
- G. Fill vertical joints with mortar.
- H. Make joints 3/8 inch, unless otherwise indicated on the drawings.
- I. Leave head joints in copings and similar units upon for sealant.
- J. Rake mortar joints 3/4 inch for pointing.
- K. Tuck point mortar joints to slight concave profile.
- L. Remove excess mortar immediately.

M. Remove mortar fins and smears before tooling joints.

N. Sealant Joints:

1. As specified in Sections 07910 "Joint Fillers & Gaskets" and 07920 "Sealants & Caulking".
2. Prime ends of cast stone units, insert properly sized backing rod, and install sealant.
3. Provide sealant joints at following locations:
 - a. Cast stone units with exposed tops.
 - b. Joints at relieving angles.
 - c. Control and expansion joints.
 - d. As indicated on the drawings.

3.03 TOLERANCES

A. Installation Tolerances: Comply with Cast Stone Institute Technical Manual.

1. Variation from Plumb: Do not exceed 1/8 inch in 5 feet or 1/4 inch in 20 feet or more.
2. Variation from Level: Do not exceed 1/8 inch in 5 feet, 1/4 inch in 20 feet, or 3/8 inch maximum.
3. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch or 1/4 of nominal joint width, whichever is greater.
4. Variation in Plane Between Adjacent Surfaces: Do not exceed 1/8-inch difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

3.04 CLEANING

A. Clean exposed units after mortar is thoroughly set and cured.

B. Wet surfaces before applying cleaner.

C. Apply cleaner to cast stone units in accordance with cleaner manufacturer's instructions.

D. Perform test of cleaner on small area and receive approval by Architect before full cleaning.

E. Do **not** use the following to clean cast stone units:

1. Muriatic acid.
2. Power washing.
3. Sandblasting.

2. Harsh cleaning materials or methods that would damage or discolor surfaces.

3.05 REPAIR

- A. Repair chips and other surface damage noticeable when viewed in direct daylight at 20 feet.
- B. Repair with touchup materials provided by manufacturer in accordance with manufacturer's instructions.
- C. Repair methods and results to be approved by Architect.

3.06 INSPECTION AND ACCEPTANCE

- A. Inspect completed installation in accordance with Cast Stone Institute Technical Manual.

3.07 PROTECTION

- A. Protect installed cast stone from splashing, stains, mortar, and other damage.

END OF SECTION 04720

SECTION 05120 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes structural steel and grout

1.02 DEFINITIONS

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

1.03 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.

- 1. Select and complete connections using schematic details indicated and AISC 360.
- 2. Use ASD; data are given at service-load level.

- B. Moment Connections: Type FR, fully restrained.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
- C. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer and fabricator.
- B. Welding certificates.
- C. Mill test reports for structural steel, including chemical and physical properties.
- D. Source quality-control reports.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD, or have an equivalent quality assurance program as certified by a qualified independent testing agency.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE, or have an equivalent quality assurance program as certified by a qualified independent testing agency.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303.
 - 2. AISC 360.
 - 3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- E. Preinstallation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS

2.01 STRUCTURAL-STEEL MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. W-Shapes: ASTM A 992/A 992M.
- C. Channels, Angles, Shapes: ASTM A 36/A 36M.
- D. Plate and Bar: ASTM A 36/A 36M.
- E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
- F. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
- G. Welding Electrodes: Comply with AWS requirements.

2.02 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy-hex steel structural bolts[or tension-control, bolt-nut-washer assemblies with splined ends]; ASTM A 563, Grade DH, (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers with plain finish.

1. Direct-Tension Indicators: ASTM F 959, Type 490 (ASTM F 959M, Type 10.9), compressible-washer type with plain finish.
- C. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers.
 1. Finish: Hot-dip zinc coating] [Mechanically deposited zinc coating] [Hot-dip or mechanically deposited zinc coating].
 2. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with [mechanically deposited zinc coating] [mechanically deposited zinc coating, baked epoxy-coated] finish.
- D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, [heavy-hex] [round] head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 1. Finish: [Plain] [Mechanically deposited zinc coating].
- E. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- F. Unheaded Anchor Rods: ASTM F 1554, Grade 36, or ASTM F 1554, Grade 55, weldable (refer to Structural Steel Notes on drawings for additional information).
 1. Configuration: Straight.
 2. Finish: Plain.
- G. Headed Anchor Rods: ASTM F 1554, Grade 36 or ASTM F 1554, Grade 55, weldable, straight (refer to Structural Steel Notes on drawings for additional information).
 1. Finish: Plain.
- H. Threaded Rods: ASTM A 36/A 36M.

1. Finish: Plain, or hot-dip zinc coating
ASTM A 153/A 153M, Class C, if exposed to weather.

2.03 PRIMER

- A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Primer: Comply with [Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."] [Section 099600 "High-Performance Coatings."] [Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."]
- C. Primer: SSPC-Paint 25, [Type I] [Type II], zinc oxide, alkyd, linseed oil primer.
- D. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.04 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.05 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
- B. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end

welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

2.06 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened, unless noted otherwise.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.07 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).

2. Surfaces to be field welded.

3. Surfaces to be high-strength bolted with slip-critical connections.

4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).

5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 3, "Power Tool Cleaning."

2. SSPC-SP6, "Commercial Blast Cleaning" for galvanized surfaces.

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming

methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.08 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123.
- B. Galvanize above the roof and outside the building envelope (exposed to weather).

2.09 SOURCE QUALITY CONTROL

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

PART 3 - EXECUTION

3.01 EXAMINATION

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

3.02 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base, Bearing, and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.03 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened, unless noted otherwise.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

3.04 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency (Special Inspector, refer to Structural drawings for additional information) to inspect field welds, and, high-strength bolted connections.
- B. Bolted Connections: Bolted connections will be[tested and] inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.

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DOWNTOWN DEVELOPMENT AUTHORITY
2016 PLACEMAKING PROJECT

161675

FEBRUARY 9, 2018

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

END OF SECTION 051200

SECTION 05500 - METAL FABRICATIONS

PART 1. GENERAL

1.01 RELATED DOCUMENTS

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this specification.

1.02 SECTION INCLUDES

- A. Work included in this section consists of furnishing all labor, materials, equipment and incidentals required for complete installation of miscellaneous metal work shown on the drawings, as specified herein, and/or as needed for a complete and proper installation whether shown or not.

1.03 QUALITY ASSURANCE

- A. 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.
- B. Perform shop and/or field welding required in connection with the work of this Section in strict accordance with pertinent recommendations of the American Welding Society.
- C. Fabricator Qualifications: Firm experienced in producing metal fabrications similar to those indicated for this project with a record of successful in-service performance, and with sufficient production capacity to produce required units without delaying the work.
- D. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code—Steel," AWS D1.2 "Structural Welding Code—Aluminum," and AWS D1.3 "Structural Welding Code—Sheet Steel."
 - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.04 SUBMITTALS

- A. Comply with pertinent provisions of Division 1.

- B. Product Data: Within 35 calendar days after the contractor has received the General Contractor's Notice to Proceed, submit:
 - 1. Shop drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this section with the work of adjacent trades. Provide templates for anchors and bolts specified for installation under other sections.
 - 2. Submit signed and sealed calculations for steel pipe railings by the registered professional engineer registered in the State of Michigan responsible for their preparation.

1.05 PROJECT CONDITIONS

- A. Field Measurements: Check Actual locations of walls and other construction to which metal fabrications must fit by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.
 - 1. Where field measurements cannot be made without delaying the work, guarantee dimensions and proceed with fabricating products without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

PART 2. PRODUCTS

2.01 MATERIALS

- A. In fabricating items which will be exposed to view, limit materials to those which are free from surface blemishes, pitting, rolled trade names, and roughness.
- B. Comply with following standards as pertinent:
 - 1. Steel plates, shapes and bars: ASTM A36.
 - 2. Steel plates to be bent or cold-formed: ASTM A283, Grade C.
 - 3. Steel tubing: ASTM A501, Grade B.
 - 4. Cold-finished steel bars: ASTM A108.
 - 5. Cold-rolled carbon steel sheets: ASTM A336.
 - 6. Galvanized carbon steel sheets: ASTM A526, with G90 zinc coating in accordance with ASTM A525.

7. Steel pipe: ASTM A53, Grade B, standard weight, black finish unless otherwise noted.
8. For exterior installations and where indicated, provide members with hot-dip galvanizing coat per ASTM A53.
9. Concrete inserts:
 - a. Threaded or wedge type galvanized ferrous castings of malleable iron complying with ASTM A27.
 - b. Provide required bolts, shims, and washers, hot-dip galvanized in accordance with ASTM A153.

2.02 FASTENERS

A. General:

1. For exterior use and where built into exterior walls, provide zinc-coated fasteners.
2. Provide fasteners of type, grade, and class required for the particular use.

B. Comply with following standards as pertinent:

1. Bolts and nuts: Provide hexagon-head regular type complying with ASTM A307, Grade A.
2. Lag bolts: Provide square-head type complying with Fed. Spec. FF-B-561.
3. Machine screws: Provide cadmium plated steel type complying with Fed. Spec. FF-S-111.
4. Washers:
 - a. Plain washers: Comply with Fed. Spec. FF-W-92, round, carbon steel.
 - b. Lock washers: Comply with Fed. Spec. FF-W-84, helical spring type carbon steel.
5. Toggle bolts: Provide type, class and style needed but complying with Fed. Spec. FF-B-588.
6. Anchorage devices: Provide expansion shield complying with Fed. Spec. FF-S-325.

2.03 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by contractor subject to the approval of the Architect.

2.04 SHOP PAINT

- A. Primer: Use "10-99 Tnemec Primer" or Architect/Engineer equal product by Rustoleum.

- B. For repair of galvanizing, use a high zinc-dust content paint complying with SSPC-paint 20. Dry film containing not less than 94 percent zinc dust by weight.
- C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

2.05 FABRICATION

- A. Except as otherwise shown on the drawings or the approved shop drawings, use materials of size, thickness, and type required to produce reasonable strength and durability in the work of this Section.
- B. Fabricate with accurate angles and surfaces which are true to the required lines and levels, grinding exposed welds smooth and flush, forming exposed connections with hairline joints, and using concealed fasteners wherever possible.
- C. Prior to shop painting or priming, properly clean metal surfaces as required for the applied finish and for the proposed use of the items.
- D. On surfaces inaccessible after assembly or erection, apply two coats of the specified primer. Change color of second coat to distinguish it from the first.
- E. Shear and punch metals cleanly and accurately. Remove burrs.
- F. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- G. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

2.06 MISCELLANEOUS METAL FABRICATIONS

- A. Rough Hardware:
 - 1. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing and supporting woodwork and for anchoring or securing woodwork to concrete or other structures. Straight bolts

and other stock rough hardware items are specified in Section 06100.

2. Manufacture or fabricate items of sizes, shapes, and dimensions required. Furnish malleable iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

B. Loose Bearing and Leveling Plates:

1. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction made flat, free from warps or twists, and of required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

C. Loose Steel Lintels:

1. Provide loose structural steel lintels for opening and recesses in masonry walls and partitions as shown. Weld adjoining members together to form a single unit where indicated. Provide not less than 8'' bearing at each side of openings, unless otherwise shown.
2. Size lintels as follows, unless otherwise indicated.
 - a. Up to 4'-0'' span: One 3 1/2'' x 4'' x 5/16'' steel angle supporting each 4'' thick module of masonry.
 - b. Spans 4'-0'' to 7'-0'': One 5'' x 3-1/2'' x 5/16'' steel angle supporting each 4'' thick module of masonry.
 - c. Over 7'-0'': Consult Architect if not indicated.
3. Hot dip galvanized loose steel lintels to be installed in exterior walls.

D. Steel Pipe Railings:

1. Provide railings and handrails capable of withstanding the following loads applied as indicated when tested per ASTM E 935.
 - a. Concentrated loads of 200 lbs. Applied at any point in any direction.
 - b. Uniform load of 50 lbs. Per linear ft. applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.

- d. Infill of Guards:
 - Concentrated load of 50 lbs. applied horizontally on an area 1 sq. ft.
 - Uniform load of 25 lb./ft. applied horizontally.
 - Infill load and other loads need not be assumed to act concurrently.
 - e. Provide X-Strong pipe (Schedule 80).
2. Interconnect railing and handrail members by butt-welding or welding with internal connectors, at fabricator's option.
 3. At tee and cross intersections provide coped joints.
 4. At bends interconnect pipe by means of prefabricated elbow fittings or flush radius bends, as applicable.
 5. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross-section of pipe throughout entire bend without buckling, twisting or otherwise deforming exposed surfaces of pipe.
 6. Provide wall returns at ends of wall-mounted handrails, except where otherwise indicated.
 7. Close exposed ends of pipe by welding 3/16" thick steel plate in place or by use of prefabricated fittings.
 8. Provide wall brackets, end closures, flanges, miscellaneous fittings and anchors for interconnections of pipe and attachment of railings and handrails to other work. Furnish inserts and other anchorage devices for connecting railings and handrails to concrete or masonry work.
- E. Miscellaneous Framing and Supports:
1. Provide miscellaneous steel framing and supports as required to complete work.
 2. Fabricate miscellaneous units to sizes, shapes, and profiles shown or, if not shown, or required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes, plates, and steel bars of welded construction using metered joints for field connection. Cut, drill and tap units to receive hardware and similar items.
 3. Hot dip galvanize exterior miscellaneous frames and supports.

PART 3. EXECUTION

3.01 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.02 COORDINATION

- A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.03 INSTALLATION

A. General:

1. Set work accurately into position, plumb, level, true and free from rack.
2. Anchor firmly into position.
3. Where field welding is required, comply with AWS recommended procedures of manual-shielded metal-arc welding for appearance and quality of weld and for methods to be used in correcting welding work.
4. Grind exposed welds smooth and touch up shop prime coats.
5. Do not cut, weld, or abrade surfaces which have been hot-dip galvanized after fabrication and which are intended for bolted or screwed field connections.

- B. Immediately after erection, clean the field welds, bolted connections and abraded areas of shop priming. Paint the exposed areas with same material used for shop priming.

END OF SECTION 05500

SECTION 06100 - CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

- A. The extent of the carpentry work is shown on the Drawings.

1.03 QUALITY ASSURANCE:

- A. Lumber Standard: Comply with U.S. Department of Commerce Product Voluntary Standards PS 1-07, "Structural Plywood", PS 2-04 Performance Standard for "Wood based structural use panels" and PS 20-05 American Softwood Lumber Standard, except as otherwise indicated.
- B. Factory mark each piece of lumber and plywood with type, grade, mill, and grading agency: West Coast Lumber Assoc. (WBLC) or Western Wood Products Association (WWPA).

1.04 SUBMITTALS:

- A. Wood Treatment Data:
 - 1. Submit treatment manufacturer's instructions for proper use of each type of treated material.
 - a. Pressure Treatment: For each type specified, include certification by treating plant stating chemicals and process used, net amount of preservative retained, and conformance with applicable standards.
 - b. For water-borne preservatives, include statement that moisture content of treated materials was reduced to a maximum of 15% prior to shipment to project site.

B. Product Data:

1. Submit manufacturer's specifications and other data for each carpentry anchorage, fastening, and miscellaneous material. Provide material certificates for all lumber and plywood. Transmit a copy of each instruction to the Installer.

1.05 PRODUCT HANDLING:

- A. Delivery and Storage: Keep materials dry during delivery and storage. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and plywood and provide air circulation within stacks.

1.06 JOB CONDITIONS:

- A. Coordination: Fit carpentry work to other work, scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow proper attachment of other work.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Lumber - General:

1. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20-05, for the moisture content specified for each use. Use dressed lumber, surfaced four sides (SFS) seasoned with 19% maximum moisture content at time of dressing.

B. Framing Lumber (2" through 4" thick):

1. For light framing (less than 6" wide), provide Construction Grade Douglas Fir as graded by the West Coast Lumber Bureau (WCLB) or equivalent species and grade with minimum fiber stress rating (bending) of 1000 psi (Fb), and modulus of elasticity of 1,500,000 psi.
2. For structural framing (6" and wider and from 2" to 4" thick) provide dense No. 1 Grade Douglas Fir as graded by the West Coast Lumber Bureau (WCLB) or equivalent species and grade with minimum fiber stress rating (bending) of 1500 psi (Fb), and modulus of elasticity of 1,700,000 psi.

C. Boards (less than 2" thick):

1. Produce lumber of 19% maximum moisture content (S-DRY) and of the following species and grade.
 - a. Redwood Construction Common (RIS).
 - b. Southern Pine No. 2 Boards (SPIB).
 - c. Or any species graded construction Boards (WCLB or WWPA).

D. Plywood:

1. Provide only Douglas Fir Plywood in accordance with grading requirements of the APA - The Engineered Wood Association as follows:
 - a. Treated non-combustible AC standard with exterior glue.

E. Anchorage and fastening Materials:

1. Select proper type, size, material, and finish for each application. Comply with the following:
 - a. Nails and Staples: FS FF-N-105.
 - b. Wood Screws: FS FF-S-111.
 - c. Bolts and Studs: FS FF-B-575.
 - d. Nuts: FS FF-N-836.
 - e. Washers: FS FF-W-92.
 - f. Lag Screws or Lag Bolts: FS FF-B-561.
 - g. Masonry Anchoring Devices: For expansion shields, nails, and drive screws, comply with FS FF-S-325.
 - h. Toggle Bolts: FS FF-B-588.
 - i. Bar or Strap Anchors: ASTM A 575 carbon steel bars.

2.02 WOOD TREATMENT:

- A. Preservation Treatment: Where lumber or plywood is indicated as "Treated" or is specified herein to be treated, comply with the applicable requirements of the American Wood Preservers Association (AWPA) AWPA P23-08, ASTM D-1625 and Federal Specification TT-W-50.

- B. Pressure-treat above-ground items with water-borne preservatives complying with AWPA P5-09, ASTM D-1760, and Federal Specification TT-W-571. After treatment, kiln-dry to a maximum moisture content of 19%. Treat indicated items and the following, except where fire retardant treated.
 - 1. Wood cants, nailers, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing members less than 12 inches above grade excepting timber.
- C. Fire Retardant Treated:
 - 1. Wood blocking and similar items installed within the building shall be pressure impregnation with retardant chemicals to achieve a flame spread rating of not more than 25 when tested in accordance with UL Test 723, ASTM E 84, or NFPA Test 355.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Installer must examine the substrates and supporting structure and the conditions under which the carpentry work is to be installed and notify the General Contractor, in writing, of conditions detrimental to the work. Do not proceed with the installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.02 INSTALLATION:

- A. General:
 - 1. Discard units of material with defects which might impair the quality of the work, and units which are too small to fabricate the work with minimum joints or the optimum joint arrangement.
 - 2. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted.

3. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required. Provide washers under bolt heads and nuts in contact with wood. Nail plywood in accordance with the recommendations of APA-The Engineered Wood Association.
4. Use common wire nails, except as otherwise shown or specified herein. Use finishing nails for exposed work. Do not wax or lubricate fasteners that depend on friction for holding power. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; pre-drill as required. Do not drive threaded friction type fasteners; turn into place. Tighten bolts and lag screws at installation and retighten as required for tight connections prior to closing in or at completion of work.

B. Wood Grounds, Nailers, Blocking and Sleepers:

1. Provide wherever shown and where required for screening or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.
2. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown. Build into masonry during installation of masonry work. Where possible, anchor to form work before concrete placement.
3. Provide permanent grounds of dressed, pressure preservative treated key-bevelled lumber not less than 1-1/2" wide and of the thickness required to bring face of ground to exact thickness of finished material involved. Remove temporary grounds when no longer required.

C. Wood Furring:

1. Install plumb and level with closure strips at all edges and openings. Shim with wood as required for tolerance of finished work.

D. Wood Framing:

1. Provide framing members of sizes and on spacings shown and frame openings as shown, or if not shown, comply with recommendations of "The Wood Frame Construction Manual'' 2001 Ed. of the American Wood Council. Do not splice structural members between supports.
2. Anchor and nail as shown, and comply with the "Recommended Nailing Schedule - Table I of the Manual for Housing Framing: and other recommendations of the N.F.P.A.

E. Installation of Plywood:

1. Comply with recommendations of the Engineered Wood Association (APA) for the installation of plywood.

END OF SECTION 06100

SECTION 06185 - STRUCTURAL GLUED-LAMINATED TIMBER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes:
 - a. Structural framing using glued-laminated timbers.
 - b. Steel connection assemblies and fasteners associated with glue laminated timbers.
 - c. Bearing plates and anchor bolts attached to masonry or concrete by drilling and setting of expansion anchors or chemical anchors.
- B. Related Sections include the following:
 - a. Division 05500 "Structural Steel" for bearing plates and anchor bolts cast into concrete and masonry.
 - b. Division 06100 "Rough Carpentry" for dimension lumber items associated with structural glued-laminated timber construction.

1.3 DEFINITIONS

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

1.4 REFERENCES

- A. Reference Standards: Comply with the following:
 - 1. Materials and Manufacture: ANSI A 190.1-92 Structural Glue Laminated Timber. AITC 110-84 Standard Appearance Grades for Structural Glue Laminated Timber.

2. Design and Manufacturing: AITC 117-93 Design Standard Specifications for Structural Glued Laminated Timber of Softwood Species.
3. Lumber: Comply with Grading Rules for Western Lumber, latest edition, as published by the Western Wood Products Association or the rules for Southern Pine Lumber, latest edition as published by the Southern Pine Inspection Bureau.

1.5 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide structural glued-laminated timber, including connectors, capable of withstanding structural loads shown on Drawings without exceeding allowable design working stresses listed in AITC 117-2004 or determined according to ASTM D3737 and acceptable to authorities having jurisdiction.

1.6 SUBMITTALS

- A. Shop Drawings: Shall be prepared under the supervision of a licensed professional engineer experienced in the design of heavy timber. Show layout of structural glued-laminated timber system and full dimensions of each member. Indicate species and laminating combination, adhesive type, and other variables in required work.
 1. Include large-scale details of connections.
 2. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by a licensed professional engineer responsible for their preparation.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provide factory-glued structural units produced by an AITC / APA licensed firm.
 1. Factory mark each piece of structural glued-laminated timber with AITC or APA Quality Mark. Place mark on surfaces that will not be exposed in the completed work

- B. Quality Standard: Comply with AITC A190.1, "Structural Glued Laminated Timber."

PART 2 - PRODUCTS

2.1 SUPPLIER

- A. Timber Systems LLC, 162 S. Saginaw St., Lapeer, MI 48446, (810) 245-6212, fax: (810) 245-6214, www.timbersystems.com

2.2 STRUCTURAL GLUED-LAMINATED TIMBER

- A. General: Provide structural glued-laminated timber that complies with AITC 117-2004 or research/evaluation reports acceptable to authorities having jurisdiction.

- 1. Provide structural glued-laminated timber made from a single species.

- B. Species and Grades for Structural Glued-Laminated Timber: Provide structural glued-laminated timber made from lumber grades needed to comply with Part 1 "Performance Requirements" Article. Utilize Southern Yellow Pine.

- C. Appearance Grade: Architectural appearance grade, complying with AITC 110.

- D. Adhesive: Wet-use type complying with ASTM D 2559.

- E. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.

2.3 TIMBER CONNECTORS

- A. General: Unless otherwise indicated, fabricate from the following materials:

- 1. Structural-steel shapes, plates, and flat bars complying with ASTM A 36/A 36M.

2. Round steel bars complying with ASTM A 575, Grade M 1020.
 3. Hot Rolled steel sheet complying with ASTM A 1011-A 1011M, Structural Steel, Type SS, Grade 33.
- B. Welded connection assemblies shall comply with AWS D1.1 Structural Welding Code - Steel and/or AWS D1.3 Structural Welding Code - Sheet Steel.
- C. Provide bolts complying with ASTM A 307, Grade A, nuts complying with ASTM A 563; and where indicated, flat washers complying with ASTM F844.
- D. Screws and other fasteners may be provided if supported by appropriate engineering analysis or documented testing.
- E. Finish steel assemblies and fasteners with rust inhibitive primer, 2-mil dry film thickness.
- F. Where indicated, provide hot-dipped galvanized steel assemblies and fasteners to comply with ASTM A 123/A 123M or ASTM A 153/A 153M.

2.4 FABRICATION

- A. Shop fabricate timber for connections to greatest extent possible, including cutting to length and drilling bolt holes.
1. Dress exposed surfaces to remove planing or surfacing marks and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
- B. Camber: Fabricate horizontal and inclined members of less than 1:1 slope with either circular or parabolic camber equal to 1/500 of span.
- C. End-Cut Sealing: Immediately after end-cutting each member to final length, apply a saturation coat of end sealer to ends and other cross-cut surfaces.

2.5 FACTORY FINISHING

A. Wiped on Stain Finish: After fabricating, sanding, and end-coat sealing, apply a heavy saturation coat of penetrating stain sealer on surfaces of each unit.

1. Provide stain color selected by Architect from manufacturer's normal range.

2.6 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with provisions in AITC 111, "Recommended Practice for Protection of Structural Glued-Laminated Timber during Transit, Storage, and Erection."

B. Individually wrap members using plastic-coated paper covering with water-resistant seams.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates in areas to receive structural glued-laminated timber, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of structural glued-laminated timber.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Provide installation using an installer with five (5) or more years of timber installation experience.

B. General: Erect structural glued-laminated timber true and plumb, with uniform, close fitting joints. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.

1. Lift with padded slings and protect corners with wood blocking.

2. Install structural glued-laminated timber to comply with Shop Drawings.
 3. Install timber connectors as indicated.
- C. Framing Built into Masonry: Provide ½-inch clearance at tops, sides, and ends of members built into masonry; bevel cut ends 3 inches; and do not embed more than 4 inches, unless otherwise indicated.
- D. Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.

3.3 ADJUSTING

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

END OF SECTION 06185

SECTION 06402 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Interior standing and running trim.
 - 2. Laminate clad cabinets (plastic-covered casework).
 - 3. Interior miscellaneous ornamental items.
 - 4. Laminated Paneling
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 6 Section 06100 "Carpentry" for furring, blocking, and other carpentry work that is not exposed to view.
 - 2. Division 9 Section 09900 "Painting" for final finishing of installed architectural woodwork.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each type of product and process specified in this section and incorporated into items of architectural woodwork during fabrication, finishing and installation.
- C. Fire-retardant treatment data for material impregnated by pressure process to reduce combustibility. Include certification by treating plant that treated materials comply with requirements.
- D. Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment

devices, and other components.

1. Plastic laminate.
2. Factory-applied opaque finishes.

E. Samples for verification purposes of the following:

1. Lumber with or for transparent finish, 50 square inches, for each species and cut, finished on one side and one edge.
2. Veneer leaves representative of and selected from flitches to be used for transparent finished woodwork.
3. Wood veneer faced panel products; with or for transparent finish, 8-1/2 inches by 11 inches, for each species and cut with one half of exposed surface finished, with separate samples of unfaced panel product used for core.
4. Lumber and panel products with factory-applied opaque finish, 8- 1/2 inches by 11 inches for panels and 50 square inches for lumber, for each finish system and color, with one half of exposed surface finished.
5. Laminate clad panel products, 8-1/2 inches, by 11 inches for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.
6. Corner pieces as follows:
 - a. Cabinet front frame joints between stiles and rail as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
 - b. Miter joints for standing trim.
7. Exposed cabinet hardware, one unit of each type and finish.

F. Product certificates signed by woodwork manufacturer certifying that products comply with specified requirements.

G. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their

capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firm experienced in successfully producing architectural woodwork similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.
- B. Single-Source Responsibility: Arrange for production by a single firm of architectural woodwork with sequence matched wood veneers.
- C. Single-Source Manufacturing and Installation Responsibility: Engage a qualified Manufacturer to assume undivided responsibility for woodwork specified in this section, including fabrication, finishing and installation.
- D. Installer Qualifications: Arrange for installation of architectural woodwork by a firm that can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this project.
- E. AWI Quality Standard: Comply with applicable requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute (AWI) except as otherwise indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage and deterioration.
- B. Do not deliver woodwork until painting, wet work, grinding, and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in "Project Conditions."

1.6 PROJECT CONDITIONS

- A. Environmental Conditions: Obtain and comply with Woodwork Manufacturer's and Installer's coordinated advice for optimum temperature and humidity conditions for woodwork during its storage and installation. Do not install woodwork until these conditions have been attained and stabilized so that woodwork is within plus or minus 1.0 percent of optimum moisture content from date of installation through remainder of construction period.
- B. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before manufacturing woodwork; show recorded measurements on final shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of Work.
 - 1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with manufacture of woodwork without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions.

PART 2 - PRODUCTS

2.1 HIGH PRESSURE DECORATIVE LAMINATE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high pressure decorative laminates which may be incorporated in the work include but are not limited to the following:
- B. Manufacturer: Subject to compliance with requirements, provide high pressure decorative laminates from:
 - 1. Wilsonart International

2.2 MATERIALS

- A. General: Provide materials that comply with requirements of the AWI woodworking standard for each type of woodwork and quality grade indicated and, where the following products are part of woodwork, with requirements of the referenced product standards that apply to product characteristics indicated:
 - 1. Hardboard: ANSI/AHA A135.4
 - 2. High Pressure Laminate: NEMA LD 3-2005.
 - a. Fire rated laminate: ASTM E84 and UL 723 and NEMA

LD3-2005.

3. Medium Density Fiberboard: ANSI A208.2.
 4. Particleboard: ANSI A208.1
 5. Softwood Plywood: PS 1.
 6. Formaldehyde Emission Levels: Comply with formaldehyde emission requirements of each voluntary standard referenced below:
 - a. Particleboard: NPA 8.
 - b. Medium Density Fiberboard: NPA 9.
 - c. Hardwood Plywood: HPM FE.
- B. Fire-Retardant Particleboard: Where indicated on the documents, provide panels complying with the following requirements that have fire-retardant chemicals bonded to softwood particles at time of panel manufacture to achieve products identical to those tested for flame spread of 20 or less and for smoke developed of 25 or less per ASTM E 84 by UL or other testing and inspecting organization acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing and inspecting organization.
1. For 45-lb-density panels and thicknesses of 3/4 inch and less, comply with ANSI A208.1 for Grade 1-M-1 except that minimums for modulus of elasticity and screw-holding capacity on face and edge shall be 300,000 psi, 250 lb, and 225 lb, respectively.
 2. For 44-lb-density panels and thicknesses of 13/16 inch to 1-1/4 inch, comply with ANSI A208.1 for Grade 1-M-1 except that minimums for modulus of rupture, modulus of elasticity, internal bond, linear expansion, and screw-holding capacity on face and edge shall be 1300 psi, 250,000 psi, 60 psi, 0.50 percent, 250 lb, and 175 lb, respectively.
 3. Product: Subject to compliance with requirements, provide "Duraflake FR" by Duraflake Div.; Willamette Industries, Inc.

2.3 FABRICATION, GENERAL

- A. Wood Moisture Content: Comply with requirements of referenced quality standard for moisture content of lumber in relation to relative humidity conditions existing during time of fabrication and in installation areas.
- B. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of cabinets and edges of solid wood (lumber) members less than 1 inch in nominal thickness: 1/16 inch.
 - 2. Edges of rails and similar members more than 1 inch in nominal thickness: 1/8 inch.
- C. Complete fabrication, including assembly, finishing, and hardware application, before shipment to project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- D. Factory-cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges of cutouts with a water-resistant coating.

2.4 FIRE-RETARDANT-TREATED LUMBER

- A. Low-Hygroscopic Formulation: Interior Type A per AWPA C20.
- B. Fire Performance Characteristics: Provide materials identical to those tested for the following fire performance characteristics per ASTM test methods indicated by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify treated lumber with classification marking of inspecting and testing organization in the form of separable paper label or, where required by authorities having jurisdiction, of imprint on lumber surfaces that will be concealed from view after installation.
 - 1. Surface Burning Characteristics: Not exceeding values indicated below, tested per ASTM E 84 for 30 minutes with no evidence of significant combustion.
 - a. Flame Spread: 25.
 - b. Smoke Developed: 50.

- C. Mill lumber after treatment, within limits set for wood removal that does not affect listed fire performance characteristics, using a woodworking plant certified by testing and inspecting organization.
 - D. Kiln-dry woodwork after treatment to levels required for untreated woodwork. Maintain moisture content required by kiln drying before and after treatment.
 - E. Discard treated lumber that does not comply with requirements of referenced woodworking standard. Do not use twisted, warped, bowed, discolored, or otherwise damaged or defective lumber.
 - F. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include but are not limited to the following:
 - 1. Koppers Company, Inc.
 - 2. Osmose Wood Preserving, Inc.
- 2.5 STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH (Chair rails; door casings; guard rails)
- A. Quality Standard: Comply with AWI Section 300.
 - B. Backout or groove backs of flat trim members and kerf backs of other wide flat members, except for members with ends exposed in finished work.
 - C. Assemble casings in plant except where limitations of access to place of installation require field assembly.
 - D. Grade: Premium.
 - E. Lumber Species: Red oak, rift sawn.
 - F. Lumber Species: Match species and cut indicated for other types of transparent finished architectural woodwork located in same area of building unless otherwise indicated.
 - 1. Provide split species on trim that face areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.
- 2.6 STANDING AND RUNNING TRIM FOR OPAQUE FINISH

- A. Quality Standard: Comply with AWI Section 300.
- B. Grade: Custom.
- C. Backout or groove backs of flat trim members and kerf backs of other wide flat members, except for members with ends exposed in finished work.
- D. Assemble casings in plant except where limitations of access to place of installation require field assembly.
- E. Lumber Species: Red Oak.

2.7 LAMINATE CLAD CABINETS (PLASTIC-COVERED CASEWORK)

- A. Quality Standard: Comply with AWI Section 400 and its Division 400B "Laminate Clad Cabinets."
- B. Grade: Custom.
- C. AWI Type of Cabinet Construction: As indicated.
- D. Laminate Cladding: High pressure decorative laminate complying with the following requirements: (provide fire-rated laminate where indicated on the documents).
 - 1. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - a. Provide selections made by Architect from laminate manufacturer's full range of standard colors and finishes in the following categories:
 - 1) Solid colors.
 - 2) Patterns.
 - 2. Laminate Grade for Exposed Surfaces: Provide laminate cladding complying with the following requirements for type of surface and grade.
 - a. Horizontal Surfaces Other Than Tops: GP-50 (0.050-inch nominal thickness).
 - b. Postformed Surfaces: PF-42 (0.042-inch nominal thickness).
 - c. Vertical Surfaces: GP-50 (0.050-inch nominal thickness).
 - d. Vertical Surfaces: GP-50 (0.050-inch nominal thickness).

3. Semiexposed Surfaces: Provide surface materials indicated below:
 - a. High pressure laminate, GP-28.

- E. Provide dust panels of 1/4-inch plywood or tempered hardboard above compartments and drawers except where located directly under tops.

- F. Provide countertops and 4'' high backsplash on all base cabinets. Countertops to be pre-manufactured Quartz surface with rounded edge, Dupont, ZODIAC in color: Sage (or approved equal)

2.8 CABINET HARDWARE AND ACCESSORY MATERIALS

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section "Finish Hardware."

- B. Cabinet Hardware Schedule: Refer to schedule at end of this section for cabinet hardware required for architectural cabinets.

- C. Hardware Standard: Comply with ANSI/BHMA A156.9 "American National Standard for Cabinet Hardware" for items indicated by reference to BHMA numbers or referenced to this standard.

- D. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for BHMA code number indicated.

1. Satin Stainless Steel, Stainless Steel Base: BHMA 630.

- E. For concealed hardware provide manufacturer's standard finish that complies with product class requirements of ANSI/BHMA A156.9.

- F. Uncoated Clear Tempered Float Glass for Doors: ASTM C 1048, Condition A, Type I, Class 1, Quality q3. Kind FT, manufactured by horizontal (roller hearth) process, with exposed edges seamed before tempering, 1/4-inch thick unless otherwise indicated.

1. Install glass to comply with applicable requirements of Division 8 Section "Glass and Glazing" and of FGMA "Glazing Manual." For glass in wood frames, secure glass with removable stops.

- G. Clear Tempered Float Glass for Shelves: ASTM C 1048, Condition A, style I, type I, quality q3, class 1, seamed at edges before tempering, 1/4-inch thick unless otherwise indicated.
 - 1. Smoke Developed: 40 or less.

- 2.9 INTERIOR MISCELLANEOUS ORNAMENTAL ITEMS FOR TRANSPARENT FINISH
 - A. Quality Standard: Comply with AWI Section 700.
 - B. Grade Premium
 - C. Lumber Species: Red Oak, rift sawn.

- 2.10 INTERIOR MISCELLANEOUS ORNAMENTAL ITEMS FOR OPAQUE FINISH
 - A. Quality Standard: Comply with AWI Section 700.
 - B. Grade: Custom.
 - C. Lumber Species: Eastern white pine, sugar pine or Idaho white pine.

- 2.11 LAMINATED PANELING
 - A. Provide Lamin-Art high pressure decorative laminate (in wood grain pattern) as shown on drawings and as specified.
 - 1. Manufacturer: Lamin-Art, Inc. Schaumburg, IL, 1-800-323-7624.
 - B. Quality Standard: NEMA Publication LD-3-2005, National Electrical Manufacturers Association.
 - C. Submittals: Provide (4) 2'' x 3'' size samples of manufacturer's standard wood grain patterns and (4) copies of manufacturer's product data sheet and installation specification for review.
 - D. Deliver, store and handle product per manufacturer's specifications. Store horizontally with the top face down and a call board placed on top to protect materials from damage and from warping. Protect laminate from moisture and from contact with floors or outside walls. Allow laminate and substrate to acclimate to site for at least 72 hours at the same ambient conditions. Optimum conditions are approximately 75°F and relative humidity of 45% to 55%. Provide air circulation around product.

E. Materials

1. Pattern number and name shall be selected by the Architect from the manufacturer's full range of wood grain patterns.
2. Grade: Standard grade GP48 (.048").
3. Finish: Velva-Tex (VT).
4. Edge: Provide miter fold edge.
5. Laminate to ½" medium density fiberboard (MDF).
 - a. Provide adhesives and process per manufacturer's specifications.
 - b. Provide with a suitable backing sheet for balanced assembly.

F. Install finished product in both wall and ceilings (in straight and curved applications) as indicated on drawings.

1. Material, equipment and workmanship shall conform to industry-standard practices, conditions, procedures and recommendations as specified in ANSI/NEMA LD3-2005 Annex A, AWI Quality Standards and ANSI 161.2-1979 standards.
2. Clean laminate with warm water and a mild soap or household cleaners approved by manufacturer.

2.12 FASTENERS AND ANCHORS

- A. Screws: Select material, type, size, and finish required for each use. Comply with FS FF-S-111 for applicable requirements.
1. For metal framing supports, provide screws as recommended by metal framing manufacturer.
- B. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.
- C. Anchors: Select material, type, size, and finish required by each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.
- B. Deliver concrete inserts and similar anchoring devices to be built into substrates well in advance of time substrates are to be built.
- C. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

3.2 INSTALLATION

- A. Quality Standard: Install woodwork to comply with AWI Section 1700 for same grade specified in Part 2 of this section for type of woodwork involved.
- B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 8'-0" for plumb and level (including tops) and with no variations in flushness of adjoining surfaces.
- C. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.
- D. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with recommendations of chemical treatment manufacturer including those for adhesives where are used to install woodwork.
- E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fastener heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.
- F. Standing and Running Trim and Rails: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns and miter at corners.

- G. Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated. Maintain veneer sequence matching (if any) of cabinets with transparent finish.
- H. Tops: Anchor securely to base units and other support systems as indicated.
- I. Complete the finishing work specified in this section to whatever extent not completed at shop or before installation of woodwork.
- J. Refer to the Division 9 sections for final finishing of installed architectural woodwork.

3.3 ADJUSTMENT AND CLEANING

- A. Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate and adjust hardware.
- C. Clean woodwork on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.4 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensures that woodwork is being without damage or deterioration at time of Substantial Completion.

3.5 HARDWARE SCHEDULE

- A. Keyboard slide and tray: Knappe & Vogt KV SRS with platform (BBP1824).
- B. Grommets: Mockett 3'' o.d. black: MQEDP3BK with fliptop tab.

END OF SECTION 06402

SECTION 07110 - MEMBRANE WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Work under this section consists of furnishing everything necessary for and incidental to the execution and completion of all waterproofing work, as indicated on the drawings and specified herein.
- B. The waterproofing system shall be applied on the earth side of all below grade foundation walls having assigned or occupied spaces on other side, areaway walls and at the horizontal top surface of exterior structural slabs above assigned or occupied areas. On vertical areas, the waterproofing shall extend from top of footings or bottom of grade beams to within two (2) inches of finish grade. Where waterproofed vertical surfaces connect to waterproofed horizontal surfaces, the horizontal waterproofing shall extend down the vertical surfaces so as to form a continuous waterproofed barrier.

1.3. JOB CONDITIONS

- A. Proceed with the installation of waterproofing only after the substrate construction has been completed, and after penetrating components have been installed, so that the membrane will not be penetrated or damaged by subsequent work.
- B. The Installer must examine the substrate and the conditions under which the work is to be performed and notify the General Contractor in writing, of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until satisfactory conditions have been corrected in a manner acceptable to the Installer.
- C. Weather Conditions: Proceed with waterproofing work only when weather conditions comply with manufacturer's recommendations, and will permit the materials to be applied and cured in accordance with those recommendations.

1.4 SUBMITTALS

- A. Manufacturer's Data: Submit two (2) copies of specifications, installation instructions and general recommendations by the manufacturer of the materials. Include manufacturer's certified test data showing compliance with the requirements.
- B. Guarantee: Submit two (2) copies of guarantee for the waterproofing work, agreeing to repair or replace membrane which leaks water, deteriorates excessively or otherwise fails to perform as required within the guarantee period, due to failure of materials or workmanship. By terms of guarantee, also agree to remove and replace other work which has been superimposed on waterproofing work, as required to repair or replace the waterproofing membrane. Guarantee shall be signed by the Contractor and by the Installer.

1. The guarantee period is five (5) years.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Sheet-Type Waterproofing: Rubberized asphalt integrally bonded to polyethylene sheet, minimum thickness, .060" per ply.
1. Products/Manufacturer:
 - Bituthene, W. R. Grace Co.
 - MEL-ROL, W.R Meadows, Inc.
 - Miradri, Mirafi, Inc.
 - Duramem 700-SM, Pecora Corporation
 - Polyguard 650, Polyguard Products, Inc.
- B. Miscellaneous Materials:
1. Primer/Filler/Sealer: As recommended, if any, by the manufacturer of the waterproofing membrane.
 2. Cant Strips and Accessories: As recommended, if any, by the manufacturer of the waterproofing membrane.
 3. Protection Course: All vertically applied membrane shall be protected with an approved type board material as recommended by the membrane manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION OF SUBSTRATE:

- A. Clean the substrate of dust, debris, oily materials and other substances detrimental to the work, and as recommended by the waterproofing manufacturer.
- B. Install cant strips and similar accessories as recommended by the waterproofing manufacturer (even though not shown), in the manner recommended by the manufacturer.
- C. Prime substrate as recommended (and only if recommended) by the waterproofing manufacturer.
- D. Mask off adjoining surfaces not to receive waterproofing, to effectively prevent the spillage or migration of primer materials outside the membrane area.

3.2 INSTALLATION

- A. General: Comply with manufacturer's instructions, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of the work.
- B. Manufacturer's Technical Representative: Start the installation of waterproofing membrane, only in the presence and with the advise of the manufacturer's technical representative.
- C. Form integral flashings, extended vertically at interruptions of the waterproofing as recommended by the manufacturer.
- D. Sealing Seams: All seams shall be overlapped not less than 2-1/2". Apply succeeding sheets with a minimum 2-1/2" overlap and roll the entire membrane firmly and completely.
 - 1. Misaligned or inadequately lapped seams shall be patched with new membrane material.
 - 2. All fishmouths shall be slit and the flaps overlapped, repaired with a patch, and pressed or rolled to seal.

- E. Corner Details: Double-cover all inside and outside corners with a minimum 12" wide strip of membrane centered on the axis of the corner. This strip shall be completely covered by the waterproofing membrane.

3.3 PERFORMANCE REQUIREMENTS:

- A. It is required that the membrane be watertight, and not deteriorate in excess of limitations published by the manufacturer. Failure of the membrane to comply with these requirements will be considered failure of materials and workmanship.

3.4 PROTECTION COURSE:

- A. Install protection course on membrane without delay, so that period of exposure will be minimized.

END OF SECTION 07110

SECTION 07160 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Attention is directed to Division 0, Bidding and Contract Requirements and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

- A. The extent of surfaces to receive bituminous dampproofing is as noted below and shown on the drawings.
- B. Apply to exterior side of CMU foundations below grade at all perimeter walls of building (unless noted to receive sheet membrane waterproofing).
- C. Related Work Specified Elsewhere:
 - 1. Section 07110 - Sheet Membrane Waterproofing
 - 2. Section 07200 - Perimeter Insulation

1.03 SUBMITTALS

- A. Product Data:
 - 1. Submit 2 copies of manufacturer's specifications, installation instructions and general recommendations for required dampproofing material. Include manufacturer's certification to other data substantiating that the materials comply with the requirements, and are recommended by the manufacturer for the application shown or specified. Indicate by copy of transmittal form that the Installer has received a copy of the instructions and recommendations.

1.04 JOB CONDITIONS:

- A. Do not proceed with dampproofing work until blocking, nailers, piping, conduit and other projections through the substrate have been installed, with substrate properly patched and sealed or flashed to receive the dampproofing.
- B. When ambient temperature is 40 degrees F or less and

falling, do not proceed with dampproofing. Do not apply dampproofing materials to frozen substrate or to any substrate in a condition not complying with manufacturer's recommendations.

- C. The Installer must examine the substrates and the conditions under which the dampproofing is to be applied and advise the General Contractor in writing of unsatisfactory conditions. Do not proceed with the dampproofing work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Asphalt Compound: Manufacturer's standard asphalt and solvent compound recommended for above-grade interior applications, compounded to penetrate substrate and build to a moisture-resistant, vapor-resistant, firm elastic coating.
 - 1. Provide semi-fibrated type semi-mastic compound FS SS-A-694.
- B. Cold-Applied, Asphalt Emulsion Dampproofing: Asphalt-based emulsions recommended by the manufacturers for dampproofing use when applied according to the manufacturer's instructions and as follows:
 - 1. Trowel Grade: Emulsified asphalt mastic, prepared with mineral-colloid emulsified agents and containing fibers other than asbestos, complying with ASTM D 1227, Type III or IV.
- C. Primer: Asphalt primer complying with ASTM D 41, for asphalt based dampproofing.
- D. Rigid protective boards shall be 1/8 inch thick similar to "Protective Course II" material by Sonneborn. Provide protective boards where perimeter insulation is not used.
- E. Odor Elimination For interior and concealed-in-wall uses, provide type of bituminous dampproofing material

which is warranted by manufacturer to be substantially odor-free after drying for 24 hours under normal conditions.

PART 3 - EXECUTION

3.01 PREPARATION OF SUBSTRATE

- A. Clean the substrate of dirt, oil, loose materials and other substances which interfere with penetration, bond or performance of dampproofing materials.
- B. Prime substrate, except where specifically recommended by manufacturer of dampproofing compound to omit primer; apply type recommended by manufacturer, at rate recommended for condition of substrate.

3.02 INSTALLATION

- A. Apply coating material in accordance with the manufacturer's printed instructions using sufficient quantity to form a continuous unbroken coating over surfaces to be dampproofed. Retouch surfaces as necessary to provide a continuous coating. Protect adjacent surfaces from damage by the dampproofing. Material applied with trowel shall have at least 1/8 inch thickness.
- B. Apply mastic in one coat directly from the container without thinning. Form a cove at the corner junction of surfaces which are coated. Joints, grooved, slots, or breaks in the surfaces shall be completely and continuously covered. Spread coating into chases, corners, reveals, or other surfaces which occur below grade. Reinforce at corners and angles with one additional thickness of membrane.
- C. Apply vertical dampproofing down walls to top of footing, but do not extend onto surfaces exposed to view when the Project is completed.

3.03 COLD-APPLIED, ASPHALT EMULSION DAMPPROOFING

- A. Trowel Grade: Trowel apply a coat of mastic asphalt

emulsion dampproofing onto substrate a minimum rate of 7 gal./100 sq. ft. to produce an average, dry-film thickness of 60 mils, but not less than 30 mils at any point.

3.04 PROTECTION

- A. After the mastic has set and solvents have left the mixture, apply protective board layer over the entire surface of the mastic, holding in place with spots of additional mastic, where wall will not be covered with perimeter insulation.

END OF SECTION 07160

SECTION 07175 - WATER REPELLENT COATINGS

PART 1. GENERAL

1.01 RELATED DOCUMENTS

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this specification.

1.02 SECTION INCLUDES

- A. Work included in this Section consists of furnishing all labor, materials, equipment and incidentals required for complete installation of water repellent coatings including clear sealer and all associated accessories mentioned or scheduled on the drawings and/or herein.

1.03 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 04100 - Mortar and Grout
- B. Section 04300 - Unit Masonry
- C. Section 04720 - Cast Stone
- D. Section 07920 - Sealants and Caulking
- E. Section 04300 - Stone

1.04 SYSTEM DESCRIPTION

- A. The exterior coating system shall consist of a liquid-applied, one or two application clear natural looking water repellent sealer.

1.05 QUALITY ASSURANCE

- A. Installation: Applicator of water repellent coating system shall be certified by the manufacturer. Copy of certification shall be submitted with shop drawings.
- B. Application: Test a small area of surface before starting general application to assure desired results and coverage rates. Clear Sealer shall be applied in accordance with manufacturer's written instructions. Apply sealer in two coats with use of recommended spray equipment.

1.06 WARRANTY REQUIREMENTS

- A. Provide ten year warranty under provisions of Division 1, ensuring the water repellent performance of the system from date of acceptance. Provisions of the warranty shall include responsibility for water penetration through peeling and flaking of the coating film.

1.07 SUBMITTALS

- A. Refer to Division 1, General Requirements, for submission procedures.
- B. Submit two samples of masonry units with finished product applied. Masonry shall be from actual units for use on this project. Examination of samples will be for color change only.
- C. Provide eight (8) copies of manufacturer's product data including installation/application instructions.

1.08 PRODUCT HANDLING

- A. Materials shall be delivered to site in original manufacturer's sealed containers.
- B. Materials shall be stored off the ground and in such a manner as to prevent any damage to containers and protect from freezing temperatures.
- C. Sealer shall be thoroughly stirred before and occasionally during use per manufacturer's written instructions.

1.09 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperatures above 50°F. 24 hours prior to application and continuously until sealer has completely dried.
- B. Do not apply sealer if rain is expected within 24 hours of application.

PART 2. PRODUCTS

2.01 MATERIALS

A. Manufacturers:

1. Hydrozo, Inc., Clear Double 7.
2. Tamms Industries Co., Chemstop Regular.
3. Rainguard - Blok Lok RTU - Penetrating Water Repellant
4. Other architect approved.

B. Coatings: Ready mixed, of good flow, spray and brushing properties, capable of drying or curing free of streaks or sags. Materials shall be resistant to fade and efflorescence.

C. Finish: Natural looking, non-textured, clear.

PART 3. EXECUTION

3.01 EXAMINATION & PREPARATION

A. Verify that substrate conditions and related work performed under other sections are acceptable for installation of work by this trade. Notify Construction Manager in writing of substrate conditions not acceptable for proper application of water repellent coating system.

B. Loose mortar shall be repointed.

C. Efflorescence shall be cleaned from surface and neutralized with product compatible with water repellent coating system.

D. Concrete/masonry shall be dry; mortar and caulking fully cured prior to application.

E. Mask all areas and items adjacent to areas to be coated, including cement and board siding, aluminum, wood, glass, shrubs, topsoil and horizontal concrete.

3.02 APPLICATION

A. Clear Sealer:

1. Surface receiving sealer must be dry per

- recommendations of sealer manufacturer.
2. Apply sealer by flooding the surface using manufacturer approved equipment and techniques. Allow excess material to run down a minimum of 12 inches. Follow-up brushing or rolling shall be performed when required by the manufacturer.
 3. If required by the manufacturer per conditions encountered, apply second coat 24 hours after the first coat at normal drying conditions.
 4. Coverage rates shall be manufacturer's required rates for brick veneer. Burnished CMU is coated with a water repellent coating as indicated in 04300 Unit Masonry and does not receive the coating under this Spec Section.

3.03 CLEANING

- A. Remove masking from all areas. Mop up puddles from all horizontal surfaces prior to removing masking; do not allow material to runoff masking onto adjacent surfaces.
- B. Clean all areas of splash or overspray per manufacturer's written instructions. Under no circumstances shall product be allowed to dry on surfaces not scheduled to receive the water repellent coating system.
- C. Promptly remove and properly dispose of all empty containers, masking and disposable applicators. Remove all equipment and staging as soon as practicable from job site.

3.04 SCHEDULE

- A. All exterior stone veneer and cast stone.
- B. All exposed poured concrete, including retaining walls and other vertical concrete surfaces of new construction (do not apply to flat concrete work; i.e. walks and slabs).

END OF SECTION 07175

SECTION 07200 - INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

- A. The extent of thermal insulation work is shown on the drawings.
- B. The applications of thermal insulation specified in this section include the following:
 - 1. Board-type building insulation.
 - 2. Blanket-type building insulation.
- C. Related Work Specified Elsewhere:
 - 1. Section 07200 - Standing Seam Metal Roof Deck/Insulation
 - 2. Section 07840 - Firestopping: For safing insulation
 - 3. Section 09250 - Gypsum Board: Acoustical batt insulation
 - 4. Division 15, Mechanical: Insulation for ducts, heating, air conditioning, ventilating, and plumbing work shall be furnished and installed by the respective Mechanical Contractor.
 - 5. Division 16, Electrical: Insulation for electrical work shall be furnished and installed by Electrical Contractor.

1.03 QUALITY ASSURANCE:

- A. Thermal Conductivity: The thickness shown are for the thermal conductivity (k-value at 75%) specified for each material. Provide adjusted thicknesses as directed for the equivalent use of material having a different thermal conductivity.
- B. Fire Ratings: Comply with the fire-resistance and flammability ratings indicated, and comply with governing regulations as interpreted by authorities including:
 - 1. UL requirements for "Roof Deck Constructions" which are rated "Fire-Acceptable".

1.04 SUBMITTALS:

A. Product Data:

1. Submit manufacturer's specifications and installation instructions for each type of insulation required. Include data substantiating that materials comply with specified requirements.

B. Shop Drawings:

1. Submit shop drawings for tapered roof area. Show all slopes, thickness, perimeter and roof sump conditions.

1.05 PRODUCT HANDLING:

- A. Protection from Deterioration: Do not allow insulation materials to become wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation. Protect plastic insulation from exposure to sunlight.
- B. Fire Hazard: Do not deliver plastic insulating materials to the project site ahead of installation time. Protect at all times against ignition. Complete installation and concealment of plastic materials as rapidly as possible in each area of work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Extruded Polystyrene Plastic Board Insulation:

1. Perimeter Edge Insulation

a. Material Properties:

1. Rigid closed-cell extruded polystyrene thermal board insulation.
2. Comply with ASTM C 578-92, Type VI, density 1.8 lb/cu. Ft. min., compressive strength 40 psi (STM D 1621-73).
3. Thermal resistance: 5-year aged R-values of 5.4 and 5.0 min. °F-ft²-h/Btu²/inch at 40°F and 75°F respectively (ASTM C 518-91).
4. Water absorption: Max 0.3% by volume (ASTM C 272-91).

- b. Thickness: 2'' unless otherwise indicated.
- c. Acceptable manufacturer's product: Dow Chemical Company ``STYROFOAM® Brand High Load (HI-40)'' material.

B. Glass Fiber Board Insulation:

- 1. Glass fibers and water-resistant binders formed into rigid, non-combustible boards complying with FS HH-I-558, Form A; thermal conductivity (k-value at 75 degrees F.) of 0.26; manufacturer's standard lengths and widths, unless otherwise shown.
 - a. Provide "CWE Type FRK Faced Board by Owens-Corning Fiberglass Corp."

C. Mineral/Glass Fiber Blanket/Batt Insulation:

- 1. Unfaced Mineral Fiber Blanket/Batt Insulation: Thermal insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C665 for type described below with thermosetting resins to comply with ASTM C665 for Type 1 (blankets without membrane facing); and as follows:
 - a. Mineral Fiber Type: Fibers manufactured from glass.
 - b. Surface Burning Characteristics: Maximum flame spread and smoke developed values of 25 and 50, respectively.
- 2. Batt insulation shall be foil faced when exterior wall or ceiling is not indicated to receive a separate vapor barrier. Locations with vapor barrier shall be unfaced. Provide batt insulation equal to or exceeding the "R" values for the following nominal indicated insulation thicknesses.
 - a. "R" = 11 for 3-1/2 inches thick insulation
 - b. "R" = 19 for 6-1/4 inches thick insulation
- 3. Foil-Faced, Glass Fiber Board Insulation: Thermal insulation combining glass fibers with thermosetting resin binders and faced on one side with foil-scrim-kraft or foil-scrim-polyethylene vapor retarder to comply with ASTM C612, Type 1A or Type 1A or 1B, and with other requirements indicated below:
 - a. Nominal density of 2.25 lb./cu. ft., thermal resistivity of 4.3 degrees F. by high by sq. ft./BTU by inch at 75 degrees F.

4. Miscellaneous Insulation: Shall be inorganic (nonasbestos) mineral wool insulation without facing, for the purpose of filling and stuffing openings in walls around pipes, structural components, windows, conduits, expansion joints to eliminate noise transfer and to insulate. Use to seal top of interior walls, except fire rated walls, between masonry and roof deck, where indicated. Use at expansion joints as detailed. Insulation shall have a flame spread rating of 15 or less, and a smoke development rating of 0; per ASTM E84.
5. All glass fiber insulation types shall be formaldehyde-free. Insulation shall be Johns Manville and meet minimum environmental specifications 1350 with non-detect pollutants for indoor air quality. Other manufacturers must be approved by Architect for comparison.

2.02 AUXILIARY INSULATING MATERIALS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated, securely in position indicated with self-locking washer in place; and complying with the following requirements:
 1. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 2. Spindle: Copper-coated low carbon steel, fully annealed, 0.105 inches in diameter, length to suit depth of insulation indicated.
 3. Insulation-Retaining Washers: Self-locking washers formed from 0.016 inch thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
 - a. Where spindles will be exposed to human contact after installation, protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap.
 4. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates.
 5. Products: Subject to compliance with requirements, provide one of the following:

- a. Adhesively attached, spindle type anchors
 1. TACTOO Insul-Hangers; AGM Industries, Inc.
Canton, MA
 2. Spindle Type Gemco Hangers; Gemco, Danville,
IL
- b. Insulation - Retaining Washers
 1. RC150; AGM Industries Inc, Canton, MA
 2. R150; Gemco, Danville, IL
- c. Adhesive
 1. TACTOO Adhesive; AGM Industries, Inc. Canton,
MA
 2. Tuff Bond Hanger Adhesive; Gemco, Danville, IL

PART 3 - EXECUTION

3.01 INSPECTION:

- A. The Installer must examine the substrate and conditions under which the insulation work is to be performed, and notify the General Contractor in writing of unsatisfactory conditions. Do not proceed with the insulation work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 INSULATION:

- A. General:
 1. Comply with manufacturer's instructions for the particular conditions of installation in each case. If printed instructions are not available or do not apply to the project conditions, consult the manufacturer's technical representative for specific recommendations before proceeding with the work.
 2. Extend insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections which interfere with placement.
 3. Apply a single layer of insulation of the required thickness unless otherwise shown or required to make up the total thickness.

B. Perimeter Insulation:

1. On vertical surfaces, set units in adhesives applied in accordance with manufacturer's instructions. Use type adhesive recommended by manufacturer of insulation.

C. General Building Insulation:

1. Apply insulation units to the substrate by the method indicated, complying with the 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.
2. Set vapor barrier faced units with vapor barrier to warm side of construction, except as otherwise shown. Do not obstruct ventilation spaces, except for firestopping.
 - a. Tape joints and ruptures in vapor barriers, using adhesive tape of type recommended by insulation manufacturer, and seal each continuous area of insulation to surrounding construction so as to ensure vapor-tight installation of the units.
3. Stuff loose mineral fiber insulation into miscellaneous voids and cavity spaces as indicated. Compact to approximately 40% of normal maximum volume (to a density of approximately 2.5 lbs. per cu. ft.).

END OF SECTION 07200

SECTION 07462 - SIDING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Factory-finished fiber cement lap siding, panels, shingle, trim, fascia, moulding and accessories; James Hardie HZ10 Engineered for Climate Siding.

1.2 RELATED SECTIONS

- A. Section 06100 - Carpentry: Wood framing and bracing.
- B. Section 07210 - Insulation: Exterior wall insulation.

1.3 REFERENCES

- A. AS D3359 - Standard Test Method for Measuring Adhesion by Tape Test, Tool and Tape.
- B. AS E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: Provide detailed drawings of atypical non-standard applications of cementitious siding materials which are outside the scope of the standard details and specifications provided by the manufacturer.

- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, minimum size 4 by 6 inches (100 by 150 mm), representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum of 2 years experience with installation of similar products.
- B. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Finish areas designated by Architect.
 - 2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
 - 3. Remodel mock-up area as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store siding on edge or lay flat on a smooth level surface. Protect edges and corners from chipping. Store sheets under cover and keep dry prior to installing.
- C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 PROJECT CONDITIONS

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

1.8 WARRANTY

- A. Product Warranty: Limited, non-pro-rated product warranty.
 - 1. HardiePlank HZ10 lap siding for 30 years.
 - 2. HardiPanel HZ10 vertical siding for 30 years.
- B. Finish Warranty: Limited product warranty against manufacturing finish defects.
 - 1. When used for its intended purpose, properly installed and maintained according to Hardie's published installation instructions, James Hardie's ColorPlus finish with ColorPlus Technology, for a period of 15 years from the date of purchase: will not peel; will not crack; and will not chip. Finish warranty includes the coverage for labor and material.
- C. Workmanship Warranty: Application limited warranty for 2 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: James Hardie Building Products, Inc., which is located at: 26300 La Alameda Suite 400 ; Mission Viejo, CA 92691; Toll Free Tel: 866-274-3464; Tel: 949-367-4980; Fax: 949-367-4981; Email: [request info \(info@jameshardie.com\)](mailto:request_info@jameshardie.com); Web: www.jameshardiepros.com.
- B. Requests for approval of equal substitutions will be considered in accordance with specifications.

2.2 SIDING AND TRIM

- A. HardiePlank HZ10 lap siding, HardiPanel HZ10 vertical siding, HardieSoffit HZ10 panels and HardieShingle HZ10 siding requirement for materials:
 - 1. Fiber-cement siding - complies with ASTM C 1186 Type A Grade II.
 - 2. Fiber-cement siding - complies with ASTM E 136 as a noncombustible material.

3. Fiber-cement siding - complies with ASTM E 84 Flame Spread Index = 0, Smoke Developed Index = 5.
 4. CAL-FIRE, Fire Engineering Division Building Materials Listing - Wildland Urban Interface (WUI) Listed Product.
 5. ICC-ES evaluation reports ESR-2290, ESR-1844, and ESR-2273 (IBC, IRC, CBC, CRC)
 6. City of Los Angeles, Research Report No. 24862.
 7. Miami Dade County, -Notice of Acceptance -15-0122.04.
 8. US Department of Housing and Urban Development Materials Release -1263f.
 9. California DSA PA-019.
 10. City of New York M EA 223-93-M.
 11. Florida State Product Approval -FL13192, FL13223, and FL13265
 12. Texas Department of Insurance Product Evaluation EC-23.
- B.** Lap Siding: HardiePlank HZ10 Lap as manufactured by James Hardie Building Products, Inc.
1. Type: Select Cedarmill 7-1/4 inches (184 mm) with 6 inches (152 mm) exposure.
- C.** Vertical Siding: HardiePanel HZ10 siding as manufactured by James Hardie Building Products, Inc.
1. Type: Sierra 8 siding panel 4 feet by 10 feet (1219 mm by 3048 mm).
 2. Type: Smooth panel 4 feet by 8 feet (1219 mm by 3048 mm)
- D.** Soffit Panels: HardieSoffit HZ10 soffit panel, factory sealed on 5 sides as manufactured by James Hardie Building Products, Inc.
1. Type: Smooth non-vented, 24 inches (610 mm) by 8 feet (2438 mm).
- F.** Trim:
1. HardieTrim HZ10 boards as manufactured by James Hardie Building Products, Inc.
 - a. Product: 5/4 Boards, 3-1/2 inch (89 mm) width.

- b. Product: 5/4 Boards, 5-1/2 inch (140 mm) width.
 - c. Product: 5/4 Boards, 7-1/4 inch (184 mm) width.
 - d. Product: 5/4 Boards, 9-1/4 inch (235 mm) width.
 - e. Product: 5/4 Boards, 11-1/4 inch (286 mm) width.
 - f. See elevations and wall sections and details for required widths.
2. HardieTrim HZ10 Fascia boards as manufactured by James Hardie Building Products, Inc.
 3. Fiber-cement trim - complies with ASTM C 1186 Type A Grade II.
 4. Fiber-cement trim - complies with ASTM E 136 as a noncombustible material.
 5. Fiber-cement trim - complies with ASTM E 84 Flame Spread Index = 0, Smoke Developed Index = 5.
 6. Intertek Product Listing.

2.3 FASTENERS

- A. Wood Framing Fasteners:
 1. Wood Framing: 8d box ring common corrosion resistant nails.
- B. Masonry Walls:
 1. Masonry Walls: Aerico Stud Nail, ET&F ASM No.-144-125, 0.14 inch (3.6 mm) shank by 0.30 inch (7.6 mm) head by 2 inches (51 mm) long corrosion resistant nails.

2.4 FINISHES

- A. Factory Finish: Multiple colors to be selected, Refer to Finish Schedule.
 1. Product: ColorPlus Technology by James Hardie.
 2. Definition: Factory applied finish; defined as a finish applied in the same facility and company that manufactures the siding substrate.
 3. Process:
 - a. Factory applied finish by fiber cement manufacturer in a controlled environment

within the fiber cement manufacturer's own facility utilizing a multi-coat, heat cured finish within one manufacturing process.

- b. Each finish color must have documented color match to delta E of 0.5 or better between product lines, manufacturing lots or production runs as measured by photospectrometer and verified by third party.
 4. Protection: Factory applied finish protection such as plastic laminate that is removed once siding is installed
 5. Accessories: Complete finishing system includes pre-packaged touch-up kit provided by fiber cement manufacturer. Provide quantities as recommended by manufacturer.
- B. Factory Finish Color for Trim, Soffit and Siding Colors to be selected by owner. Multiple colors will be used:
1. Alpine Frost JH50-10.
 2. Arctic White JH10-20.
 3. Autumn Tan JH20-20.
 4. Boothbay Blue JH70-20.
 5. Chestnut Brown JH80-30.
 6. Cobble Stone JH40-10.
 7. Countrylane Red JH90-20.
 8. Evening Blue JH70-30.
 9. Frosted Green JH60-20.
 10. Harris Cream JH80-10.
 11. Heathered Moss JH50-20.
 12. Iron Gray JH90-30.
 13. Khaki Brown JH20-30.
 14. Light Mist JH70-10.
 15. Monterey Taupe JH40-20.
 16. Mountain Sage JH50-30.
 17. Navajo Beige JH30-10.
 18. Parkside Pine JH60-30.
 19. Sail Cloth JH20-10.
 20. Sandstone Beige JH30-20.
 21. Soft Green JH60-10.
 22. Timber Bark JH40-30.
 23. Traditional Red JH90-10.
 24. Tuscan Gold JH80-20.

25. Woodland Cream JH10-30.
26. Woodstock Brown JH30-30.
27. Terra Cotta JH15-20.
28. Coral Coast JH25-20.
29. Aqua Marine JH35-20.
30. Cool Breeze JH45-20.
31. Pink Sand JH55-20.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If framing preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Nominal 2 inch by 4 inch (51 mm by 102 mm) wood framing selected for minimal shrinkage and complying with local building codes, including the use of water-resistive barriers or vapor barriers where required. Minimum 1-1/2 inches (38 mm) face and straight, true, of uniform dimensions and properly aligned.
 1. Install water-resistive barriers and claddings to dry surfaces.
 2. Repair any punctures or tears in the water-resistive barrier prior to the installation of the siding.
 3. Protect siding from other trades.
- D. Clean surfaces thoroughly prior to installation.
- E. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- F. Install a water-resistive barrier is required in accordance with local building code requirements.
- G. The water-resistive barrier must be appropriately installed with penetration and junction flashing in accordance with local building code requirements.

- H. Install Engineered for Climate HardieWrap weather barrier in accordance with local building code requirements.
- I. Use HardieWrap Seam Tape and joint and laps.
- J. Install and HardieWrap flashing, HardieWrap Flex Flashing.

3.2 INSTALLATION - HARDIEPLANK HZ10 LAP SIDING, WITH LOCK JOINT SYSTEM

- A. Install materials in strict accordance with manufacturer's installation instructions.
- B. Starting: Install a minimum 1/4 inch (6 mm) thick lath starter strip at the bottom course of the wall. Apply planks horizontally with minimum 1-1/4 inches (32 mm) wide laps at the top. The bottom edge of the first plank overlaps the starter strip.
- C. Allow minimum vertical clearance between the edge of siding and any other material in strict accordance with the manufacturer's installation instructions.
- D. Align vertical joints of the planks over framing members.
- E. Butt joints must not fall within 4 inches (102 mm) of a stud. Do not nail within 2 inches (51 mm) of the end of planks.
- F. Maintain clearance between siding and adjacent finished grade.
- G. Locate splices at least one stud cavity away from window and door openings.
- H. For proper fastener selection and fastening schedules for various wind load requirements and framing options, refer to the Technical Data Sheet at www.aspyredesign.com.
- I. Face nail to sheathing.
- J. Locate splices at least 12 inches (305 mm) away

from window and door openings.

3.3 INSTALLATION - HARDIEPANEL HZ10 VERTICAL SIDING

- A. Install materials in strict accordance with manufacturer's installation instructions.
- B. Block framing between studs where HardiePanel siding horizontal joints occur.
- C. Install metal Z flashing and provide a 1/4 inch (6 mm) gap at horizontal panel joints.
- D. Place fasteners no closer than 3/8 inch (9.5 mm) from panel edges and 2 inches (51 mm) from panel corners.
- E. Allow minimum vertical clearance between the edge of siding and any other material in strict accordance with the manufacturer's installation instructions.
- F. Maintain clearance between siding and adjacent finished grade.
- G. Specific framing and fastener requirements refer to Tables 2 and 3 in National Evaluation Service Report No. NER-405.
- H. Factory Finish Touch Up: Apply touch up paint to cut edges in accordance with manufacturer's printed instructions.
 - 1. Touch-up nicks, scrapes, and nail heads in pre-finished siding using the manufacturer's touch-up kit pen.
 - 2. Touch-up of nails shall be performed after application, but before plastic protection wrap is removed to prevent spotting of touch-up finish.
 - 3. Use touch-up paint sparingly. If large areas require touch-up, replace the damaged area with new pre-finished siding. Match touch up color to siding color through use of manufacturer's branded touch-up kits.

3.4 INSTALLATION - HARDIETRIM HZ10 BOARDS

- A. Install materials in strict accordance with manufacturer's installation instructions. Install flashing around all wall openings.
- B. Fasten through trim into structural framing or code complying sheathing. Fasteners must penetrate minimum 3/4 inch (19 mm) or full thickness of sheathing. Additional fasteners may be required to ensure adequate security.
- C. Place fasteners no closer than 3/4 inch (19 mm) and no further than 2 inches (51 mm) from side edge of trim board and no closer than 1 inch (25 mm) from end. Fasten maximum 16 inches (406 mm) on center.
- D. Maintain clearance between trim and adjacent finished grade.
- E. Trim inside corner with a single board trim both side of corner.
- F. Outside Corner Board Attach Trim on both sides of corner with 16 gage corrosion resistant finish nail 1/2 inch (13 mm) from edge spaced 16 inches (406 mm) apart, weather cut each end spaced minimum 12 inches (305 mm) apart.
- G. Allow 1/8 inch gap between trim and siding.
- H. Seal gap with high quality, paint-able caulk.
- I. Shim frieze board as required to align with corner trim..
- J. Fasten through overlapping boards. Do not nail between lap joints.
- K. Overlay siding with single board of outside corner board then align second corner board to outside edge of first corner board. Do not fasten

HardieTrim boards to HardieTrim boards.

- L. Shim frieze board as required to align with corner trim.
- M. Install HardieTrim Fascia boards to rafter tails or to sub fascia.

3.5 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 07600 - FLASHING AND SHEET METAL

PART ONE - GENERAL

1.01 WORK INCLUDED

- A. Counterflashings for membrane roofing system
- B. Copings for membrane system

1.02 RELATED WORK

- A. Section 06100 - Carpentry
- B. Section 07610 - Standing Seam Metal Roofing System

1.03 QUALITY ASSURANCE

- A. Requirements of current edition of "Architectural Sheet Metal Manual" published by Sheet Metal and Air Conditioning Contractors' National Association, Inc. ("SMACNA") shall form a part of these Specifications except as otherwise specified or shown on Drawings.

1.04 SUBMITTALS

- A. The Contractor shall submit a list of materials and description of installation methods proposed for this work for review by the General Contractor and Architect.
- B. Shop drawings and color samples will be required for Submittal. Fabrication of the work shall not commence until shop drawings bearing Subcontractor's final corrections have been reviewed and returned by the Owner's Representative.

1.05 WARRANTY/GUARANTEE

- A. The Contractor shall furnish a written Guarantee warranting all sheet metal including metal flashing to remain serviceable and in good condition for two (2) years from date of final acceptance of the building and to promptly repair and place in good condition without additional expense to the Owner any sheet metal and metal flashings which become defective within that period.
- B. Manufacturer's Standard Warranty: Warranted materials shall be free of defects in material and workmanship for five years after shipment. If, after inspection, the manufacturer agrees that materials are defective,

the manufacturer shall, at their option, repair or replace them. For decorative finish warranty, consult manufacturer.

PART TWO - PRODUCTS

2.01 MATERIALS

- A. Exposed and concealed metal flashings, including metal counterflashings and metal drip edge for concealed fabric flashing shall be of soft stainless steel cold rolled sheet or strip of Type 302/304 alloy having a 2-D dull fully annealed finish, which shall have at least its exposed portions painted after fabrication in a color to match adjoining metal work.
 - 1. Counterflashing shall be two-piece type, with flashing of at least 20 gauge stainless steel having a receiver of at least 20 gauge stainless steel.
 - 2. Metal drip flashing shall be placed over concealed flashing at lintels and all other metal flashings shall be of at least 18 gauge stainless steel.

PART THREE - EXECUTION

3.01 INSTALLATION

- A. Provide counterflashing for all base flashings where indicated on drawings. Turn metal down at least four inches over upper portion of such base flashings. Provide flashings at roof curbs and where else required to make roofing and sheet metal watertight.
- C. Provide and install drip flashings for fabric concealed flashing over steel lintels at heads of openings, doors, and windows, and where else shown in exterior walls.
- D. Insulate sheet metal from other materials using roofing felt, roofer's mastic, bituminous paint or other materials acceptable to Owner's Representative.

END OF SECTION 07600

SECTION 07610 - STANDING SEAM METAL ROOFING SYSTEM

PART ONE - GENERAL

1.01 SECTION INCLUDES:

- A. Preformed, prefinished metal roofing and flashings.
- B. Miscellaneous trim, flashing, closures, drip flashing, and accessories.
- C. Sealant
- D. Fastening devices.

1.02 RELATED SECTIONS

- A. Section 06100: Pre-Fabricated Wood Trusses
- B. Section 05500: Metal Fabrications.
- C. Section 06100: Carpentry.
- D. Section 07600: Flashing and Sheet Metal.
- E. Section 07920: Sealants.

1.03 REFERENCES

- A. American Iron & Steel Institute (AISI) Specification for the Design of Cold formed Steel Structural Members.
- B. ASTM A-525 Steel Sheet, Zinc-Coated (Galvanized)
- C. ASTM E-1680
- D. ASTM E-1646
- E. ASTM E-1592
- E. Spec Data Sheet - Aluminum Zinc Alloy Coated Steel (Galvalume) Sheet Metal by Bethlehem Corp.
- F. SMACNA - Architectural Sheet Metal Manual.
- G. Building Materials Directory - Underwriter's Laboratories, Test Procedure 580.

1.04 ASSEMBLY DESCRIPTION

- A. The roofing assembly includes preformed sheet metal panels, related accessories, valleys, hips, ridges, eaves, corners, rakes, miscellaneous flashing and attaching devices.

1.05 SUBMITTALS

- A. Submit detailed drawings showing layout of panels, anchoring details, joint details, trim, flashing, and accessories. Show details of weatherproofing, terminations, and penetrations of metal work.
- B. Submit a sample of each type of roof panel, complete with factory finish.

- C. Submit results indicating compliance with minimum requirements of the following performance tests:
 - 1. Air Infiltration ASTM E 1680
 - 2. Water Infiltration ASTM E 1646
 - 3. Wind Uplift - U.L.90

- D. Submit calculations with registered engineer seal, verifying roof panel and attachment method resists wind pressures imposed on it pursuant to applicable building codes.

1.06 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in Architectural Sheet Metal Products with ten (10) years minimum experience.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Upon receipt of panels and other materials, installer shall examine the shipment for damage and completeness.

- B. Panels should be stored in a clean, dry place. One end should be elevated to allow moisture to run off.

- C. Panels with strippable film must not be stored in the open, exposed to the sun.

- D. Stack all materials to prevent damage and to allow for adequate ventilation.

1.08 WARRANTY

- A. Paint finish shall have a twenty year guarantee against cracking, peeling and fade (not to exceed 5 N.B.S. units).

- B. Galvalume material shall have a twenty year guarantee against failure due to corrosion, rupture or perforation.

- C. Applicator shall furnish guarantee covering watertightness of the roofing system for the period of two (2) years from the date of substantial completion.

- D. Provide manufacturers standard watertight warranty on the roofing system for a period of 20 years from the date of substantial completion.

PART 2 PRODUCT

2.01 ACCEPTABLE MANUFACTURERS

- A. Berridge Manufacturing Company, Houston, Texas.
- B. No Substitutions.

2.02 SHEET MATERIALS

- A. Prefinished Metal shall be Hot-Dipped Galvanized - ASTM A446-85 Grade C G90 Coating A525-86 24 Gauge core steel or prefinished galvalume-ASTM 792-86 AZ-55.
- B. Unfinished Metal shall be Grade C Galvalume ASTM 792-86, AZ 55, "Satin Finish".
- C. Finish shall be full strength Kynar 500 Fluoropolymer coating, applied by the manufacturer on a continuous coil coating line, with a top side dry film thickness of 0.70 to 0.90 mil over 0.25 to 0.35 mil prime coat, to provide a total dry film thickness of 0.95 to 1.25 mil. Bottom side shall be coated with primer with a dry film thickness of 0.25 mil. Finish shall conform to all tests for adhesion, flexibility, and longevity as specified by the Kynar 500 finish supplier.
- D. Strippable film shall be applied to the top side of the painted coil to protect the finish during fabrication, shipping and field handling. This strippable film must be removed immediately before installation.

2.03 ACCESSORY MATERIALS

- A. Fasteners: Stainless Steel with washers where required.
- B. Sealant: Sealant must be a ultra low modulus, high performance, one-part, moisture curing silicone joint sealant. (do not use a clear sealant or sealants which release a solvent or acid during curing).

Sealant must be resistant to environmental conditions such as wind loading, wind driven rain, snow, sleet, acid rain, ozone, ultraviolet light and extreme temperature variations.

Features must include joint movement capabilities of +100% & -50% ASTM C-719, capable of taking expansion, compression, transverse and longitudinal movement, service temperature range -65°F to 300°F (-54°C to 149°C), Flow, sag or slump: ASTM C-639; Nil, Hardness (Shore A): ASTM C-661; 15, Tensile strength at maximum elongation: ASTM D-412; 200 psi, Tensile strength at 100% elongation: ASTM D-412; 35 psi, Tear strength, (die "C"); ASTM D-624; 40 pli, Peel strength (Aluminum, Glass, Concrete): ASTM C-794; 30 pli

C. Vinyl Weatherseal Insert.

2.04 FABRICATION

- A. All exposed adjacent flashing shall be of the same material and finish as the roof panels.
- B. Hem all exposed edges of flashing on underside, 1/2 inch.

2.05 PREFORMED METAL PANELS, STANDING SEAM METAL ROOF:

A. BERRIDGE TEE-PANEL - STANDING SEAM ROOF PANEL

- 1. Panels shall have 12-3/4" on center seam spacing with a seam height of 1".
- 2. Panels shall be site-formed with the Berridge Model SS-14 Portable Roll Former in continuous lengths with a 4' min. radius to conform to solid sheathed curved substrates.
- 3. Snap-on seams shall be 1" in height and shall contain the Berridge factory-applied Extruded Vinyl Weather Seal Insert (Patent No. 4641475) to prevent siphoning of moisture through the standing seam.
- 4. Concealed anchor clips shall be spaced as required to meet uplift loads (provide 12" on center maximum).
- 5. Panel assembly shall bear Underwriters Laboratories Label UL90, pursuant to Construction Number 296 and applicable Fire Ratings.
- 6. Certification shall be submitted based on independent testing laboratory, indicating no measurable water penetration or air leakage beyond allowable tolerances through the system when tested in accordance with ASTM E-331-86 and E-283-84.
- 7. Color: To be determined from manufacturer's standard colors.

B. VENTED SOFFIT PANELS: BERRIDGE VENTED VEE-PANEL

1. 24 gauge galvanized panels shall have vee grooves spaced at 4 ¼" o.c., with a coverage of 12 ¾" and panel depth of 3/8", with concealed fasteners and interlocking sidelap with channel drain interlock with 6.46 square inches of net free area per lineal foot of panel.
2. Panels shall be formed in continuous lengths per soffit length (40' max) and shall have no exposed fasteners.
3. Attachment to metal supports with #8 x 12" TEKS screws at maximum spacing of 2'-0" on center or per local code, whichever is greater.
4. Color: To be determined from manufacturer's standard colors.

PART 3 EXECUTION

3.01 INSPECTION

A. Substrate:

1. Examine plywood deck to ensure proper attachment to framing.
2. Inspect roof deck to verify deck is clean and smooth, free of depressions, waves or projections, level to ¼" in 20', and properly sloped to eaves.
3. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.
4. Verify deck is dry and free of snow or ice. Joints in wood deck to be solidly supported and nailed.

B. Underlayment:

1. Verify ice & water shield membrane has been installed over entire substrate below metal roofing.
2. One (1) layer of #30 asphalt roofing felt paper for roof slopes of 3:12 and up, two (2) layers for roof slopes of 1:12 - 3:12 in moderate climates.
3. Ensure felt installed horizontally, starting at eave to ridge with a 6" minimum overlap and 18" endlaps.
4. Ensure that all nail heads are totally flush with the substrate. Nails shall be galvanized roofing nails with Berridge Coated Felt Caps.

3.02 INSTALLATION

- A. Comply with manufacturers standard instructions and conform to standards set forth in the Architectural Sheet Metal Manual published by SMACNA, in order to achieve a watertight installation.
- B. Install panels in such a manner that horizontal lines are true and level and vertical lines are plumb.
- C. Install starter and edge trim before installing roof panels.
- D. Remove protective strippable film prior to installation of roof panels.
- E. Attach panels using manufacturer's standard clips and fasteners, spaced in accordance with approved shop drawings.
- F. Install sealants for preformed roofing panels as approved on shop drawings.
- G. Do not allow panels or trim to come into contact with dissimilar materials.
- H. Do not allow traffic on completed roof. If required, provide cushioned walk boards.
- I. Protect installed roof panels and trim from damage caused by adjacent construction until completion of installation.
- J. Remove and replace any panels or components which are damaged beyond successful repair.

3.03 CLEANING

- A. Clean any grease, finger marks or stains from the panels per manufacturer's recommendations.
- B. Remove all scrap and construction debris from the site.

3.04 FINAL INSPECTION

- A. Manufacturer's Field Service: a factory authorized service representative to test and inspect metal roof panel installation including accessories. Report results in writing.

- B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.
- C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

END OF SECTION 07610

SECTION 07711 - COMMERCIAL GUTTER SYSTEM

PART I GENERAL

1.01 RELATED DOCUMENTS

- A. The provisions included under Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements are included as part of this section as though bound herein.

1.02 SUMMARY

- A. Provide labor, material, and equipment necessary for furnishing a complete installation of industrial series commercial gutter system.
- B. Related Work Specified Elsewhere
 - 1. Division 6 Sections for nailers and support framing.
 - 2. Division 7 Sections for related roofing materials.

1.03 SUBMITTALS

- A. Product Data: Each type of product specified. Submit manufacturer's detailed technical product data, installation instructions and recommendations, dimensions of individual components, profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation of industrial series commercial gutter system including fully dimensioned roof plans, expansion joint locations, sections and details of components and other related trims.
- C. Finish & Color Selection: Furnish manufacturer's technical data for custom colors.

1.04 QUALITY ASSURANCE

- A. Where pre-engineered manufactured products are specified, other field fabricated or shop/field fabricated substitutions will not be accepted. However, where shop/field fabrications are indicated pre-engineered systems will be considered with Architect approval.

- B. Obtain all components and related accessories from one single source manufacturer.
- C. Follow manufacturer's printed instructions for installing commercial gutter system. Follow primary roofing manufacturer's printed instructions for installing associated roof material for flashing gutter system to roof.

1.05 DELIVERY, STORAGE & HANDLING

- A. All products delivered shall be stored in a clean dry location prior to installation.
- B. Products furnished with strippable protective masking shall not be exposed to direct sunlight for more than 30 minutes without removing masking.
- C. Do not install finished materials with scars or abrasions.

1.06 PRODUCT CONDITIONS

- A. Coordinate work of this Section with adjoining work for proper sequencing to ensure protection from inclement weather and to protect materials and their finish against damage.
- B. Do not install commercial gutter system during inclement weather. When installing in cold climates, warm adhesives, caulks, and primers to at least 50 degrees Fahrenheit prior to application.

1.07 DESIGN PERIMETERS

- A. Commercial Gutter System shall conform to all local building codes and SMACNA design perimeters for architectural sheet metal.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide commercial gutter system, accessories, and drainware as manufactured by Perimeter Systems, a division of Southern Aluminum Finishing Company, Inc. 143 Charlotte, Suite 102, Sanford, North Carolina 27330, 1-800-334-9823.

2.02 TYPE

- A. Provide Perimeter Systems' Industrial Series Commercial Gutter System "Profile G4", 6" size, Model Number G4-R6.

2.03 MATERIALS & FABRICATION

- A. Gutter shall be manufactured from .063" Kynar color to match roofing system in 10'-0" lengths. Gutter shall be:
 - 1. Manufactured with 1" telescoping and notched end.
 - 2. Factory punched with fastening holes elongated to allow for thermal movement.
 - 3. Press formed on a CNC press to provide repeated true and accurate profiles.
- B. Support Brackets shall be manufactured from 0.125"x1.00" factory extruded aluminum bar punched for fasteners.
- C. Interior Straps shall be manufactured from 0.125"x 1.00" extruded aluminum (mill finish).

2.04 ACCESSORIES

- A. Mitered Corners, provide factory-mitered corners.
- B. Sculptured End Caps, provide factory end caps at all gutter ends and wall abutments.
- C. Gutter Expansion Joint, provide manufacturer's elastomeric expansion joints with exterior cover plates at 40' intervals or as shown on drawings.

2.05 DRAINWARE

- A. Downspout & Elbows, provide rectangular extruded downspout Model Number DS-EX in sizes and locations as indicated on

plans. Downspouts shall be manufactured from 1/25 aluminum custom Kynar finished to match gutter fascia. Downspout elbows shall have hellicarc welded joints.

- B. Outlets, at all downspout locations provide aluminum outlets to connect liner to downspout.
- C. Wall Brackets, provide Style 1 Wall brackets at 30" maximum spacing (minimum 2 brackets). Brackets shall be manufactured from 0.125"x1.00" extruded aluminum bar, finished to match downspout.
- D. Provide downspout extensions of 5'-0" from exterior walls and provide concrete splash block at each downspout termination.

2.06 FINISHES

- A. General: Apply coatings to exposed aluminum components after fabrication for maximum coating performance and to prevent crazing, abrasion, and damage to finish surfaces.
- B. Pretreatment: Aluminum components shall be pretreated with solutions to remove organic and inorganic surface soils, remove residual oxides, followed by chrome phosphate conversion coating to which organic coatings will firmly adhere.
- C. Coating Type: High Performance Coating, two-coat, shop applied, 70% Polyvinylidene Fluoride (PVDF) coating based on Elf Atochem, Inc. Kynar 500 or Ausimont U.S.A., Inc. Hylar 5000 resin, meeting AAMA 2605 specification.
- D. Color: Custom color to match Standing Seam Roofing System.

PART 3 EXECUTION

3.01 EXAMINATION

- A. The installer must examine substrates and conditions under which commercial gutter system will be installed. All wood plates and/or fascia boards shall be installed true, straight, and free of splits, cracks, or other irregularities. Do not proceed with installation until unsatisfactory conditions are corrected.

3.02 PREPARATION

- A. Prior to the installation of the industrial series commercial gutter system, soffits, extenders, and associated trims shall be installed.
- B. Installer shall thoroughly read and follow manufacturer's installation instructions before proceeding with installation.

3.03 INSTALLATION

- A. General: The industrial series commercial gutter system shall be installed in strict accordance with manufacturer's printed instructions. Deviations from the instructions are not allowed.
- B. Support Brackets: Layout support brackets to provide $\frac{1}{2}$ " slope in 40 linear feet. Install support brackets with #10 x 2" stainless steel wood screws.
- C. Gutter: Install gutter onto support brackets and fasten to substrates with 1-1/2" aluminum or stainless steel nails. Rivet and seal gutter joints with high grade exterior sealant as recommended by gutter manufacturer.
- D. Expansion Joints: Install elastomeric expansion joints as shown on plans and/or shop drawings. Maximum expansion joint spacing shall be 40' centers.
- E. Install interior straps by fully engaging them into liner and fascia, complete by securely riveting.

END OF SECTION 07711

SECTION 07840 - FIRESTOPPING

PART I - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this section.

1.02 DESCRIPTION OF WORK:

- A. Provide labor and materials necessary for complete installation of firestopping materials and systems. Section includes firestopping for the following:
 - 1. Penetrations through fire resistance rated floor and roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
 - 2. Penetrations through fire resistance rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits and other penetrating items.
 - 3. Penetrations through smoke barriers and construction enclosing compartmentalized area involving both empty openings and openings containing penetrating items.
 - 4. Sealant joints in fire resistance rated construction.

1.03 SUBMITTALS:

- A. Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL or other nationally recognized independent testing laboratories firestop systems to be used and manufacturer's installation instructions.
 - 1. Submit material safety data sheets (MSDS) provided with product delivered to jobsite.

- B. Product certificates signed by manufacturers of firestopping products certifying that their products and installation comply with specified requirements. Certification shall be signed by the Installer.

1.04 QUALITY ASSURANCE:

- A. Conform to applicable governing codes, including local governing authorities, but not limited to the following:
 - 1. 2015 MBC
- B. Meet requirements of ASTM E814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated and other ASTM Standards as applicable for the installation.
 - 1. ASTM E84 "Test Method for Surface Burning Characteristics of Building Materials".
 - 2. ASTM E119 "Test Methods for Fire Tests of Building Construction and Materials".

PARTS 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with through-penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products by one of the following:
 - 1. Hilti Construction Chemicals, Tulsa, OK
 - 2. Specified Technologies Inc. (STI) Sommerville, NJ
 - 3. 3M Fire Protection Products, St. Paul, MN
 - 4. The Rectorseal Corp., Houston, TX
 - 5. Tremco, Inc. Beachwood, OH

2.02 FIRESTOPPING, GENERAL

- A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.
 - 1. All materials shall comply with ASTM E814 or E119 (UL 1429) and shall be manufactured of non-toxic, non-hazardous, asbestos free materials, and unaffected by water or moisture when cured.

2. Primers: Conform to manufacturer's recommendations for primers required for various substrate and conditions.
 3. Backup materials: Backup materials, supports, and anchoring devices shall be provided as required by UL testing.
- B. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "System Performance Requirements" in Part 1. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire resistance rated system. Accessories include but are not limited to the following items:
1. Permanent forming/damming/backing materials must be noncombustible and may include the following:
 - a. Semirefractory fiber (mineral wool) insulation.
 - b. Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
 - c. Joint fillers for joint sealants.
 2. Temporary forming materials.
 3. Substrate primers.
 4. Collars.
 5. Steel sleeves.

2.03 FIRE STOPPING, MATERIALS

- A. Use only firestopping products that have been UL 1479 or ASTM E814 tested for specific fire rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire rating involved for each separate instance.
- B. For penetrations by noncombustible items including steel pipe, copper pipe, rigid steel conduit, and electrical metallic tubing (EMT), the following materials are acceptable:
1. Hilti FAS 601 Elastomeric Firestop Sealant
 2. STI SpecSeal Sealant SSS 100
 3. 3M Fire Barrier CP25
 4. The RectorSeal Corp. Metacaulk 1000, 950, 835, Putty, & Mortar.

5. Fyre-Sil, Tremco, Inc.
 6. Biofireshield K10 and K2 Mortar, Biostop 500+, Biootherm 100/22200 & Biostop Putty, The RectorSeal Corp.
- C. For penetrations by combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe (closed piping systems) the following materials are acceptable:
1. STI Wrap Strip SSW12
 2. Hilti FS One Intumescent Firestop Sealant
 3. 3M Fire Barrier FS-195 Wrap Strip
 4. Metacaulk Wrap Strip, Firestop Collars, Metacaulk 1000, 950 & 835.
 5. Biostop Wrap Strip, Collar, and Biostop 500+.
- D. For large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following materials are acceptable:
1. STI SpecSeal lightweight mortar SSM22B or putty
 2. Hilti FS635 Trowelable Firestop Compound
 3. 3M Fire Barrier FS-195 Composite Sheet
 4. Biofireshield K-10 & K2 mortar
 5. Metacaulk Firestop Mortar
- E. For fire-rated construction joints and other gaps with movement, the following materials are acceptable:
1. Hilti FS 601 Elastomeric Firestop Sealant
 2. STI Pensil 300
 3. 3M (Dow Corning Fire Stop Sealant 2000)
 4. Fyre-Sil, Tremco, Inc.
 5. Biofireshield, Biostop 700, Biostop 500+
 6. Metacaulk 1000 & 1100
- F. Provide a firestopping system with an "F" rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:
 - 1. Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.
 - 2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form release agent from concrete.

3.03 INSTALLING THROUGH-PENETRATION FIRESTOPS

- A. General: Comply with the manufacturer's installation instructions and drawings pertaining to products and applications indicated.
- B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross sectional shapes and depths required to achieve fire ratings of designate through-penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:

1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
2. Apply materials so they contact and adhere to substrate formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 INSTALLING FIRE RESISTIVE JOINT SEALANTS

- A. General: Comply with the manufacturer's installation instructions and drawings pertaining to products and application indicated.

3.05 CLEANING

- A. Clean off excess fill materials and sealant adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.

END OF SECTION 07840

SECTION 07910 - JOINT FILLERS AND GASKETS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

- A. The extent of each type of joint filler and gasket work is indicated on the drawings and by provisions of this section, and is hereby defined to include required fillers and gaskets not specified in other sections of these specifications.
- B. The required applications of joint fillers and gaskets include, but are not necessarily limited to, the following general types and locations:
 - 1. Pavement, curb and sidewalk joint fillers.
 - 2. Isolation and expansion joint fillers in structural concrete.
 - 3. Exterior wall component joint fillers.
 - 4. Floor construction/expansion joint fillers.
 - 5. Joint fillers around penetrations of equipment and services through walls, floors and roofs.

1.03 SUBMITTALS:

- A. Product Data:
 - 1. Submit manufacturer's specifications, installation instructions and recommendations for each type of material required.
- B. Samples:
 - 1. Submit three, 12 inches long samples of each joint filler or gasket.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL:

- A. Size and Shape: Provide sizes and shapes of units as shown or, if not shown, as recommended by manufacturer for joint size and condition shown. Where joint movement is a factor in a determination of size, consult with Architect to determine nature and magnitude of anticipated joint movements for the temperature and condition of project at time of installation.
- B. Compressibility: Specified hardness and compressibilities are intended to establish requirements for normal or average conditions of installation and use. Where a range of hardness or compressibility is available for a product, comply with manufacturer's recommendations for specific condition of use.
- C. Color: Provide each concealed material in manufacturer's standard color which has best overall performance characteristics for application shown. Provide exposed materials in black, except where another color is indicated.
- D. Compatibility: Before purchase of each filler or gasket material, confirm that it is compatible with substrate, sealants and other materials in joint system.
- E. Adhesives: Pressure sensitive adhesives, compatible with each material in joint system may be applied (at installer's option) to one face of joint fillers and gaskets to facilitate installation and permanent anchorage. Do not allow adhesives to contaminate sealant bond surface (if any) in joint system.

2.02 CONCRETE CONTROL/EXPANSION JOINT FILLERS:

- A. Bituminous and Fiber Joint Filler:
 - 1. Provide resilient and non-extruding type premolded bituminous impregnated fiberboard units complying with ASTM D 1751, FS HH-F-341, Type 1 and AASHO M 213.

2. Provide one of the following products:

- a. Flexcell-Knight-Celotex Corporation
- b. Expansion-Joint Filler; BASF/Sonneborn
- c. FF-14. Asphalt Fiber-Board; Progress Unlimited
- d. Fibre Expansion Joint; W.R. Meadows, Inc.
- e. Conflex Fiber Expansion Control Joint Filler, JD Russell

2.03 CELLULAR/FOAM EXPANSION JOINT FILLERS:

A. Closed-Cell PVC Joint Filler:

1. Provide flexible expanded polyvinyl chloride complying with ASTM D 1667. Grade VE 41 BL (3.0 psi compression deflection); except provide higher compression deflection grades as may be necessary to withstand installation forces.

2. Provide one of the following products:

- a. FF2 PVC: Progress Unlimited, Inc.
- b. Vinyl "U" 1000 Series: Williams Products, Inc.

2.04 GASKETS:

A. Molded Neoprene Gasket:

1. Provide extruded neoprene or EPDM gaskets complying with ASTM D 2000, Designation 2BC 415 to 3BC 620, black (40 to 60 Shore A durometer hardness); of the profile shown or, if not shown, as required by the joint shape, size and movement characteristics to maintain a watertight and airtight seal.

2. Provide products by one of the following manufacturers:

- a. D.S. Brown Company
- b. Hohmann & Barnard, Inc.
- c. Kirkhill Rubber Company
- d. Progress Unlimited, Inc.
- e. JD Russell
- f. Williams Products, Inc.

2.05 MISCELLANEOUS MATERIALS:

A. Oakum Joint Filler:

1. Provide untreated hemp or jute fiber rope, free of oil, tar and other compounds which might stain surfaces, contaminate joint walls or not be compatible with sealants.

B. Fire-Resistant Joint Filler:

1. Glass fiber or other inorganic non-combustible fiber formed with minimum of binder into resilient joint filler strips or blankets of sizes and shapes indicated, recommended by manufacturer specifically for increasing fire resistance or endurance of joint systems of type indicated, for service temperatures up to 2300 degrees F, 80% (min.) recovery 50% compression.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Installer must examine joint surfaces of units to receive fillers or gaskets and conditions under which the work is to be performed and notify the General Contractor, in writing, of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.02 INSTALLATION:

- A. Comply with manufacturer's instructions and recommendations for installation of each type of joint filler or gasket required, unless more stringent requirements are shown or specified.
- B. Set units at proper depth of position in joint to coordinate with other work, including installation of bond breakers, backer rods, and sealants. Do not leave voids or gaps between ends of joint filler units.
- C. Recess exposed edges or faces of gaskets and exposed joint filler slightly behind adjoining surfaces, unless otherwise shown, so that compressed units will not protrude from joints.

- D. Bond ends of gaskets together with adhesive or by means as recommended by manufacturer to ensure continuous watertight and airtight performance. Miter-cut and bond ends at corners except where molded corner units are provided.

END OF SECTION 07910

SECTION 07920 - SEALANTS AND CAULKING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

- A. The extent of each type of sealant and caulking work is indicated on the drawings, and by provisions of this section.
- B. The required applications of sealants and caulking include, but are not necessarily limited to, the following general locations:
 - 1. Flashing reglets and retainers.
 - 2. Exterior wall joints.
 - 3. Masonry control joints, exterior and interior.
 - 4. Interior sound-sealed and air-sealed joints.
 - 5. Flooring joints.
 - 6. Isolation joints, between structure and other elements.
 - 7. Paving and sidewalk joints.
 - 8. Joints at penetrations of walls, decks and floors by piping and other services and equipment.
 - 9. Joints between items of equipment and other construction.
 - 10. Joints between dissimilar materials.

1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms with not less than 5 years of successful experience in production of types of sealants and caulking compounds required for this project.
 - 1. Obtain elastomeric sealants from a manufacturer which will, upon request, send a qualified technical representative to the project site for purpose of advising installer on proper procedures for use of products.

- B. Installer: A firm with a minimum of 5 years of successful experience in application of types of materials required.

1.04 SUBMITTALS:

A. Product Data:

- 1. Submit manufacturer's specifications, recommendations and installation and instructions for each type of sealant, caulking compound and associated miscellaneous material required.

B. Samples:

- 1. Submit three, 12" long samples of each color required (except black) for each type of sealant and caulking compound exposed to view. Install sample between two strips of material similar to or representative of typical surfaces where compound will be used, held apart to represent typical joint widths.

1.05 JOB CONDITIONS:

- A. Pre-Installation Meeting: At General Contractor's direction, installer, sealant manufacturer's technical representative, and other trades involved in coordination with sealant work shall meet with General Contractor at project site to review procedures and time schedule proposed for installation of sealants in coordination with other work. Review each major sealant application required on project.

- B. Weather Conditions: Do not proceed with installation of sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended temperature range for installation. Proceed with the work only when forecasted weather conditions are favorable for proper cure and development of high early bond strength. Where joint width is affected by ambient temperature variations, install elastomeric sealants only when temperatures are in lower third of the manufacturer's recommended installation temperature range, so that sealant will not be subjected to excessive elongation and bond stress at subsequent low temperatures. Coordinate time schedule with General Contractor to avoid delay of project.

- C. Statement of Non-Compliance: Where it is necessary to proceed with installation of sealants or caulking compound under conditions which do not fully comply with requirements (because of time schedule or other reasons which the General Contractor determines to be crucial to project), prepare written statement for Owner's record indicating the nature of non-compliance, reasons for proceeding, precautionary measures taken to ensure best possible work, and names of individuals concurring with decision to proceed with installation.

1.06 SPECIAL PROJECT WARRANTY (GUARANTEE):

- A. Sealant Warranty: Provide written warranty, signed by contractor and installer, agreeing to, within warranty period of 10 years after date of substantial completion, replace/repair defective materials and workmanship defined to include: Instances of significant leakage of water or air; failures in joint adhesion, material cohesion, abrasion resistance, strain resistance or general durability; failure to perform as required, and the general appearance of deterioration in any other manner not clearly specified in manufacturer's published product literature as an inherent characteristic of the sealant material. Warranty includes responsibility for removal and replacement of other work (if any) which conceals or obstructs the replacement of sealants.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL:

- A. Colors: Provide black or other natural color where no other standard or custom color is available. Where material is not exposed to view, provide manufacturer's standard color which has best overall performance characteristics for application shown.
1. Provide manufacturer's standard colors as selected by Owner's representative from manufacturer's standard colors.
- B. Hardnesses shown and specified are intended to indicate general range necessary for overall performance. Consult manufacturer's technical representative to determine actual hardness recommended for conditions of installation and use. Upon request, Architect will furnish information concerning anticipated joint movement related to actual joint width and installation temperature. Except as otherwise indicated or

recommended, provide compounds within the following range of hardness (Shore A, fully cured, at 75 degrees F.).

1. 5 to 20 for high percentage of movement and minimum exposure to weather and abrasion (including no exposure to vandalism).
2. 15 to 35 for moderate percentage of movement and moderate exposure to weather and abrasion.
3. 30 to 60 for low percentage of movement and maximum exposure to weather and abrasion (including foot traffic on horizontal joints).

C. Modulus of Elasticity: For joints subjected to movement, either thermal expansion or dynamic movement, select sealants from among available variations which have lowest modulus of elasticity which is consistent with exposure to abrasion or vandalism. For horizontal joints subject to traffic, select sealants with high modulus of elasticity as required to withstand indentation by stiletto heels. Comply with manufacturer's recommendations where no other requirements are indicated.

D. Compatibility: Before selection and purchase of each specified sealant, investigate its compatibility with joint surfaces, joint fillers and other materials in joint system. Provide only materials (manufacturer's recommended variation of specified materials) which are known to be fully compatible with actual installation conditions as shown by manufacturer's published data or certification.

2.02 SEALANTS:

- A. One Part Elastomeric Sealant (Silicone)
 1. One component elastomeric sealant, complying with ASTM C 920, Class 25, Type NS (nonsag), unless Type S (self-leveling) recommended by manufacturer for the application shown.
 - a. Acceptable Standard
 1. "Pecora 864 Architectural Silicone Sealant; Pecora Corp.
 2. Dow Corning 791; Dow Corning Corp.
 3. Silpruf; General Electric
 4. Omniseal; Sonneborn Building Products, Inc.
 5. Spectrem 2; Tremco Mfg. Co.

2. One-Component mildew resistant silicone sealant:
(Around countertops and backsplashes and other wet interior locations).
 - a. Acceptable Standard
 1. Rhodorsil 6B white; Rhone-Poulenc Inc.
 2. Dow Corning 786; Dow Corning Corp.
 3. Sanitary 1700; General Electric
 3. One Component high movement joints (+100/-50):
Where locations of high movement are indicated.
 - a. Dow Corning 790; Dow Corning Corp.,
 - b. Spectrem 1; Tremco
- B. Elastomeric Sealant (Polyurethane)
1. One component polyurethane sealant, complying with ASTM C 920, Type S, Grade NS, Class 25 (nonsag).
 - a. Acceptable Standard
 1. Sonolastic NP 1; Sonneborn Building Products Inc.
 2. Dymonic; Tremco Mfg. Co.
 3. Dynatrol I; Pecora Corp.
 4. Vulkem 921; Mameco
 5. CS 2130; Hilti
 6. Sikaflex 1A; Sika Corp.
 7. Sikaflex 15LM; Sika Corp.
 2. Two Component polyurethane sealant, complying with ASTM C 920, Type M, Grade NS, Class 25 (nonsag).
 - a. Acceptable Standard
 1. Sonolastic NP 2; Sonneborn Building Products Inc.
 2. Dymeric; Tremco Mfg. Co.
 3. Dynatrol II; Pecora Corp.
 4. Vulkem 922; Mameco
 5. Sikaflex LCNSEZ; Sika Corp.
- C. One-part self-leveling polyurethane sealant (for traffic areas).
1. One Component polyurethane self-leveling sealant, complying with ASTM C 920, Type S, Grade P, Class 25.
 - a. Acceptable Standard
 1. Sonolastic SL 1; Sonneborn Building Products Inc.
 2. NR-201 Urexpan; Pecora Corp.
 3. Vulkem 45; Mameco
 4. Sikaflex 1CSL; Sika Corp.

2. Two-component polyurethane self-leveling sealant, complying with ASTM C 920, Type M, Grade P, Class 25.
 - a. Acceptable Standard
 1. Sonolastic SL 2; Sonneborn Building Products Inc.
 2. NR-200 Urexpan; Pecora Corp.
 3. Vulkem 245; Mameco
 4. THC900/THC901; Tremco
 5. Sikaflex
- D. Security Sealant (Polyurethane)
 1. One component or two component polyurethane sealant, complying with ASTM C 920, Grade NS, Class 12.5, with a Shore A Hardness of 55.
 - a. Acceptable Standard
 1. Dynaflex; Pecora Corp.
 2. Ultra; Sonneborn Building Products, Inc.

2.04 CAULKING COMPOUNDS:

- A. Caulking Compounds: (Acrylic Latex Sealant)
 1. Latex rubber modified, acrylic emulsion polymer sealant compound; manufacturer's standard, one part, nonsag, mildew resistant, acrylic emulsion sealant complying with ASTM C 834, formulated to be paintable and recommended for exposed applications on interior locations involving joint movement of not more than plus or minus 5 percent.
 2. Acceptable Standard
 - a. Sonolac, Sonneborn Building Products Inc.
 - b. Acrylic Latex Caulk 834, Tremco Inc.
 - c. Acrylic Latex Caulk with Silicone, DAP
 - d. AC-20, Pecora Corp.

2.05 MISCELLANEOUS MATERIALS:

- A. Joint Cleaner: Provide type of joint cleaning compound recommended by sealant or caulking compound manufacturer, for joint surfaces to be cleaned.
- B. Joint Primer/Sealer: Provide type of joint primer/sealer recommended by sealant manufacturer, for joint surfaces to be primed or sealed.
- C. Bond Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer, to be applied to sealant-contact surfaces where bond to

substrate or joint filler must be avoided for proper performance of sealant. Provide self-adhesive tape where applicable.

- D. Sealant Backer Rod: Compressible rod stock polyethylene foam, polyethylene jacketed polyurethane foam butyl rubber foam, neoprene foam or other flexible, permanent, durable non-absorptive material as recommended for compatibility with sealant by the sealant manufacturer.
- E. Provide size and shape of rod which will control joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back side, and provide a highly compressible backer to minimize possibility of sealant extrusion when joint is compressed.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. The installer must examine joint surfaces, backing and anchorage of units forming sealant rabbet and condition under which sealant work is to be performed and notify the General Contractor in writing of conditions detrimental to proper completion of the work and performance by sealants. Do not proceed with sealant work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.02 SELECTION OF MATERIAL

- A. Caulking compounds shall be used for interior nonmoving joints and at locations indicated.
- B. One component elastomeric silicone sealants shall be used at exterior and interior joints where thermal or dynamic movement is anticipated including, but not limited to, the following locations:
 - 1. Metal to metal joints.
 - 2. Sheet metal flashing, coping, preformed metal caps, fascias, extenders, trim, and panels.
- C. One or two component elastomeric polyurethane sealants shall be used at exterior and interior joints where weatherproofing or waterproofing is required and at exterior joints between dissimilar materials including, but not limited to, the following locations:

1. Expansion and control joints.
 2. Exterior side of hollow metal frames to adjacent materials.
 3. Exterior side of aluminum frames to adjacent dissimilar materials.
 4. Lintels and shelf angles to masonry construction.
 5. Louvers to adjacent construction.
 6. Vertical interior expansion joints and horizontal interior and exterior control joints and expansion joints in the building.
 7. Joints in concrete site improvements (sidewalks, ramps, retaining walls) and the joint between the concrete slabs and dissimilar materials.
 8. Sealant in pipe sleeves where materials must perforate the floor slab.
 9. Perimeter of floor slabs or concrete curbs which abut vertical surfaces.
 10. Exterior joints between dissimilar materials where the joining of the two surfaces leaves a gap between the meeting materials or components as may be dictated by the various methods of construction to make watertight.
 11. Exterior locations which are noted "caulked" or "sealant" and not specifically listed herein or included in the work of other sections of the Specifications.
 12. Interior joints between dissimilar materials where the joining of the 2 surfaces leave a gap between the meeting materials and components.
- D. One or two part self-leveling polyurethane sealants shall be used for exterior and interior horizontal joints subject primarily to pedestrian traffic and light and moderate vehicular traffic.
- E. Security sealant shall be used in vertical control joints in the interior side of building.

3.03 JOINT SURFACE PREPARATION:

- A. Clean joint surfaces immediately before installation of sealant or caulking compound. Remove dirt, insecure coatings, moisture and other substances which would interfere with bond of sealant or caulking compound.
- B. For elastomeric sealants, do not proceed with installation of sealant over joint surfaces which have been painted, lacquered, waterproofed or treated with water repellent or other treatment or coating unless a laboratory test for durability (adhesion), in

compliance with paragraph 4.3.9. of FS TT-S-00227 has successfully demonstrated that sealant bond is not impaired by coating or treatment. If laboratory test has not been performed or shows bond interference, remove coating or treatment from joint surfaces before installing sealant.

- C. Etch concrete and masonry joint surfaces to remove excess alkalinity, unless sealant manufacturer's printed instructions indicate that alkalinity does not interfere with sealant bond and performance. Etch with 5% solution of muriatic acid; neutralize with dilute ammonia solution, rinse thoroughly with water and allow to dry before sealant installation.
- D. Roughen joint surfaces on vitreous coated and similar non-porous materials, where sealant manufacturer's data indicated lower bond strength than for porous surfaces. Rub with fine abrasive to produce a dull sheen.

3.04 INSTALLATION:

- A. Comply with sealant manufacturer's printed instructions except where more stringent requirements are shown or specified and except where manufacturer's technical representative directs otherwise.
- B. Prime or seal joint surfaces where shown or recommended by sealant manufacturer. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.
- C. Install sealant backer rod for liquid sealants, except where shown to be omitted or recommended to be omitted by sealant manufacturer for the application shown.
- D. Install bond breaker tape where shown and where required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.
- E. Employ only proven installation techniques, which will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

- F. Install sealants to depths as shown or if not shown as recommended by sealant manufacturer but within the following general limitations, measured at center (thin) section of bead.
1. For sidewalks, pavement and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75% of joint width and neither more than 5/8" deep nor less than 3/8" deep.
 2. For normal moving joints sealed with elastomeric sealants, but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than 1/2" deep nor less than 1/4" deep.
 3. For joints sealed with non-elastomeric sealants and caulking compounds, fill joints to a depth in the range of 75% to 125% of joint width.
- G. Spillage: Do not allow sealants or compounds to overflow or spill onto adjoining surfaces or to migrate into voids of adjoining surfaces including exposed aggregate panels and similar rough textures. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces but either primer/sealer or the sealant/caulking compound.
- H. Remove excess and spillage of compounds promptly as the work progresses. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage without damage to adjoining surfaces or finishes.
- I. Polysulfide Sealant Installation: Comply with standards issued by Thiokol Chemical Corp., except where more stringent requirements have been shown or specified, or have been issued by sealant manufacturer as either requirements or recommendations.

3.04 CURE AND PROTECTION:

- A. Cure sealants and caulking compounds in compliance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength and surface durability. Do not cure in a manner which would significantly alter materials modulus of elasticity or other characteristics.

- B. Installer shall advise the General Contractor of procedures required for curing and protection of sealants and caulking compounds during construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at time of Owner's acceptance.

END OF SECTION 07920

SECTION 08210 - FLUSH WOOD DOORS

PART 1. GENERAL

1.1 SECTION INCLUDES: Wood doors non-rated and fire-rated

- A. Solid core flush wood doors

1.2 RELATED SECTIONS

- A. Section 08112 - Hollow metal work
- B. Section 08710 - Finish hardware

1.3 REFERENCES AND REGULATORY REQUIREMENTS

- A. ASTM E152 - Methods of Fire Tests and Door Assemblies.
- B. NFPA 252 - Standard Methods for Fire Assemblies.
- C. UBC 7-2-1994
- D. UBC 7-2, 1997
- E. Michigan Building Code 2015
- F. UL 10 (c) - Fire Tests for Door Assemblies - Positive Pressure
- G. UL 10 (b) - Fire Tests for Door Assemblies - Neutral Pressure
- H. NFPA 80 - Fire Doors and Windows.
- I. Quality Standards:
 - 1. WDMA Industry Standard I.S. 1A-04
 - 2. ANSI A115. W Series, Wood Door Hardware Standards. (American National Standard Institute)
- J. Labeling Agencies
 - 1. Intertek Testing Services-Warnock Hersey (ITS-WH)
 - 2. Underwriters Laboratories (UL)

1.4 SUBMITTALS

- A. Shop drawings: Indicate location, size, and hand of each door; elevation of each kind of door; location and extent of hardware blocking; and other pertinent data.
 - 1. Indicate dimensions and locations of mortises and holes for hardware.
 - 2. Indicate dimensions and locations of cutouts.
 - 3. Indicate requirements for veneer matching.
 - 4. Indicate doors to be factory finished and finish requirements.
 - 5. Indicate fire ratings for fire doors.

- B. Samples for Initial Selection: Color charts consisting of actual materials in small sections for the following:
 - 1. Faces for Factory Finished doors: Show the full range of colors available for stained finishes.
- C. Samples for Verification:
 - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide one piece of the expected finished work.

1.5 QUALITY ASSURANCE

- A. Source limitations: Obtain flush wood doors through one source from a single manufacturer.
- B. Quality standard: Comply with WDMA I.S.1-A 04
- C. Fire-rated Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UBC 7-2-1997 (Positive Pressure)

1.6 DELIVERY STORAGE AND HANDLING AND SITE CONDITIONS

- A. Deliver, store, protect and handle products under provisions of WDMA.
- B. Package doors individually and wrap bundles of doors. Inspect for damage. Do not store in damp or wet areas. HVAC systems should be operating and balanced prior to arrival of doors. Acceptable humidity shall be no less than 25% nor greater than 55%.
- C. Certain wood species are light sensitive. Protect doors from exposure to natural and artificial light after delivery.

1.7 WARRANTY

- A. Provide manufacturer's warranty for Interior Solid Core Doors:
 - 1. Full Lifetime Warranty

PART 2. PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
 - 1. Flush wood doors:
 - a. Marshfield DoorSystems. Basis of Design-Signature Series Doors
 - 2. Or Equal Products by:
 - a. Algoma Hardwoods, Inc.
 - b. Eggers Industries
 - c. Oshkosh Door Company
 - d. Mohawk Flush Doors - Masonite Company
- B. Substitutions allowed only with written approval by architect prior to bid date.

2.2 DOOR CONSTRUCTION, GENERAL

- A. WORKMANSHIP
 - 1. Comply with WDMA I.S. 1A-04
- B. PERFORMANCE STANDARD
 - 1. Comply with WDMA I.S. 1A-04 Extra Heavy Duty
- C. DOORS FOR TRANSPARENT FINISH:
 - 1. Grade: Premium, with A Grade Faces
 - 2. Wood veneer Species and Cut: Plain sliced red oak
 - 3. Match between veneer leaves: Book match
 - 4. Assembly of spliced veneers: Running
 - 5. Pair and Set match: Provide for doors hung in same opening or separated only by mullions.
 - 6. Door with Transom: Continuous match
- D. DOORS FOR OPAQUE FINISH:
 - 1. Medium Density Overlay

- E. Interior Veneer-faced doors:
 - 1. Stiles and rails bonded to core, then entire unit abrasive planed before veneering.
- F. Rating: Positive pressure Category A (concealed intumescent).

2.3 SOLID-CORE DOORS

A. NON-FIRE RATED WOOD DOORS

- 1. Non-rated and 20-minute rated
 - a. LD-2 Particleboard, PC-5
 - b. Structural Composite Lumber, SCLC-5
 - c. Stave lumber core, SLC-5
- 2. Provide manufacturers standard laminated-edge construction with improved screw-holding capability and split resistance.
- 3. 20-minute rated pairs:
 - a. Provide with fire-retardant stiles matching face veneer that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals.
 - b. As required by manufacturer to permit positive pressure "S" label per Category H.

B. FIRE RATED WOOD DOORS

- 1. Manufacturer's standard mineral-core construction as needed to provide fire rating indicated.
- 2. Blocking: provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as needed to eliminate through-bolting hardware for surface applied hardware.
- 3. Provide manufacturers standard laminated-edge construction with improved screw-holding capability and split resistance that are labeled and listed to provide fire rating indicated.

4. Pairs: Metal edges.

2.4 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:
 - 1. WDMA prefit clearances for factory fit doors
 - 2. NFPA 80 for fire rated doors
 - 3. Manufacturers hardware templates
- B. Factory machine doors for hardware that is not surface applied. Comply with final hardware schedules, door frame Shop Drawings, and hardware templates.
 - 1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
- C. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standard for kind(s) of doors(s) required.
 - 1. Light openings: Trim openings with moldings of material and profile indicated.
 - 2. Louvers: Factory install louvers in prepared openings.
- D. Apply appropriate labels.

2.5 FACTORY FINISH

- A. General: Comply with WDMA finish requirements.
- B. Finish doors at factory.
- C. Transparent Finish:
 - 1. Finish: WDMA TR-6 catalyzed polyurethane.
 - 2. Staining: As selected from manufacturers standard colors.
- D. Factory finished doors to be installed just prior to

substantial completion.

2.6 FACTORY GLAZING

- A. Glazing in wood doors to be installed by wood door manufacturer.

2.7 ACCESSORIES

- A. GLAZING STOPS
 - 1. Non-Rated:
 - a. Wood, of the same species/compatible with door species.
 - 2. Fire-Rated:
 - a. Veneer wrapped rolled steel, of same species as door facing.
- B. APPLIED MOLDINGS:
 - 1. As selected from manufacturer's standard profiles and install as detailed.
 - 2. Applied moldings to be affixed to the door without the use of nails or staples.

PART 3. EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed frames before hanging doors.
 - 1. Verify that frames comply with indicated requirements for type, size, location and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects prior to hanging.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, Refer to Division 8 Section 08710 "Finish Hardware."
- B. Manufacturer's written instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Align all doors for uniform clearance at each edge.

D. Factory finished doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Adjust all doors to swing and operate freely.

END OF SECTION 08210

SECTION 08305 - ACCESS DOORS & PANELS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

- A. The extent, location and size of each type of access door required are shown on the drawings.
- B. Related work specified elsewhere:
 - 1. Gypsum Drywall Section 09250
 - 2. Division 15 Mechanical
 - 3. Division 16 Electrical

1.03 QUALITY ASSURANCE:

- A. Fire-Resistance Ratings: Wherever a fire-resistance classification is indicated, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in Underwriters' Laboratories, Inc. "Classified Building Materials Index" for the rating shown.
 - 1. Provide UL label on each fire-rated access door.
- B. Size Variations: Obtain Architects' acceptance of manufacturer's standard size units which may vary slightly from sizes indicated.
- C. Manufacturer: Provide access doors as manufactured by one of the following:
 - 1. Larsens
 - 2. Karp Associates Inc.
 - 3. Milcor
 - 4. Babcock-Davis

D. Inserts and Anchorages:

1. Furnish inserts and anchoring devices which must be built into other work for the installation of access doors. Coordinate delivery with other work to avoid delay.

1.04 SUBMITTALS:

A. Manufacturer's Data:

1. For information only, submit 2 copies of manufacturer's technical data and installation instructions for each type of access door assembly. Transmit copy of each instruction to the Installer.
 - a. Provide setting drawings, templates, instructions and directions for installation of anchorage devices.

PART 2 - PRODUCTS

2.01 MATERIALS & FABRICATION:

- A. General: Furnish access door assemblies manufactured as an integral unit, complete with all parts and ready for installation.
- B. Steel Access Doors and Frames: Fabricate units of continuous welded steel construction, unless otherwise indicated. Grind welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of the type required to secure access panels to the types of support shown.
- C. Frames:
 1. Unless noted otherwise, fabricate from 12 gauge steel (16 gauge for ceiling applications). Hot dip galvanize (per ASTM A123) frames which are to be installed on the exterior. For exterior ceiling applications, provide .045 6063-T5 extruded aluminum door frame.

2. Fabricate frame with exposed flange approximately 1'' wide around perimeter of frame for units installed in the following construction.
 - a. Exposed masonry.
 - b. Drywall finish.
3. For installation in masonry construction, furnish frames with adjustable metal masonry anchors.

D. Flush Panel Doors:

1. Unless noted otherwise, fabricate from not less than 12 gage sheet steel (16 gage for ceiling applications) with concealed spring hinges set to open to 175 degrees. Finish with manufacturer's factory-applied prime paint. Hot dip galvanize (per ASTM A123) which are to be installed on the exterior. For exterior ceiling applications, provide 26 ga. pre-finished embossed galvanized steel door.
2. Provide flush panel doors, unless otherwise indicated.
3. For fire-rated units, provide manufacturer's standard insulated flush panel doors.

E. Locking Devices:

1. Interior: Furnish flush, spanner head cam locks of the number required to hold door in flush, smooth plane when closed.
2. Exterior: Furnish flush, mortise locks of the number required to hold door in a flush smooth plane when closed. Provide key operated cam lock for exterior ceiling access panels.

F. Schedule: Provide the following types of access panels (basis of design is Larsens):

1. Wall Applications: Model L-DPM minimum size 36'' x 36'' with masonry anchors where required and prep for spanner head cam lock provided by Larsens. Provide where indicated on mechanical/electrical/architectural drawings or required by code to access existing/new valves, junction boxes, etc.

- a. At fire rated locations provide Model L-DPFB (with masonry anchors for wall applications where required) and prep for spanner head cam lock provided by Larsens. 36'' x 36'' minimum for wall applications. Rating shall be same as wall fire rating on drawings.
2. Interior Ceiling Application: Model L-DWR minimum size 24'' x 24'' with prep for spanner head cam lock provided by Larsens. Provide where indicated on architectural referenced ceiling/mechanical/electrical drawings or required by code to access existing/new valves, junction boxes, etc.
 - a. At fire rated locations provide model L-FRAP and prep for spanner head cam lock provided by Larsens. 24'' x 24'' for ceiling applications. Rating shall be same as ceiling fire rating on drawings.
3. Exterior Ceiling Application: Model L-LCP min. size 36'' x 48'' with prep for key operated cam lock provided by Larsens. Provide with neoprene gasketing. Provide where indicated on drawings.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Installer must examine the conditions under which access doors are to be installed and notify the General Contractor, in writing, of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 INSTALLATION:

- A. Comply with manufacturer's instructions for installation of access doors.
- B. Coordinate installation with work of other trades.
- C. Set frames accurately in position and securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces.

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- D. Adjust hardware and panels after installation for proper operation.
- E. Remove and replace panels or frames which are warped, bowed or otherwise damaged.

END OF SECTION 08305

SECTION 08310 - WOOD POCKET DOORS

PART 1 - GENERAL

1.01 SUMMARY

- A. Related Documents -
Drawings and general provisions of the Contract,
including General and Supplementary Conditions and
Division 1 Specification sections, apply to the work
specified in this section.
- B. Section Includes:
 - 1. Factory Prefitting and Premachining
 - 2. Wood Pocket Doors with hardware
 - 3. Factory Finishing of Doors
- C. Related Sections
 - 1. Section 06100 - Carpentry
 - 4. Section 08710 - Door Hardware Schedule
 - 5. Section 08800 - Glazing Schedule
 - 6. Section 09900 - Painting

1.02 REFERENCES

- A. ASTM D-1037 -91 American Society for Testing and
Materials: Standard Methods for Evaluating the
Properties of Wood-Based Fiber and Particle Board
Panel Materials.
- B. ANSI A208.1 - Urea-formaldehyde Emissions
- C. ASTM E 152-81a - Standard Methods of Fire Tests of
Door Assemblies.
- D. WDMA I.S.6-A-07 - Window and Door Manufacturers
Association.
- E. Architectural Woodwork Standards, latest edition,
published jointly by the Architectural Woodwork
Institute, the Architectural Woodwork Manufacturer
Association of Canada, and the Woodwork Institute.
- F. NFPA 80 - Fire Doors and Windows
- G. NFPA 252 - Standard Methods of Fire Tests for fire
Door Assemblies
- H. Michigan 2015 Building Code
- I. ADA

1.03 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Section 01300. Indicate:
1. Door number
 2. Door Type
 3. Door Sizes
 4. Handing
 5. Door elevations
 6. Hardware Set Numbers
 7. details of construction
- B. Samples :
1. Submit 12" x 12" door corner samples as required by the architect showing door construction, panel and sticking details as specified
 2. For factory prefinished doors - submit 6" x 6" samples to architect for approval of veneer or painted type material as specified.
- C. Templates: Hardware templates for hardware mounted on doors will be submitted under Section 08710 directly to door manufacturer immediately after acceptance of hardware schedule. Report failure to receive templates with reasonable promptness to General Contractor.
- D. Product Data: Submit door manufacturer's product construction data including, core construction, stile and rail details, panel and sticking details and any trim or glazing details as appropriate for doors specified. Product data should indicate compliance with specifications.
- E. Quality Assurance:
1. Manufacturer : Shall be a company specializing in the manufacture of stile and rail doors specified in this section for a minimum of 10 years. All Wood pocket doors shall be supplied and manufactured by one company. **All details including panels, sticking and profiles shall match**

2. Storage and Handling : Doors shall be stored and handled in accordance with the manufacturer's recommendations and the WDMA - Appendix Section - "Care and Installation at Job Site".
 - i. Doors shall be stored on a flat and level surface in a well ventilated dry building. Doors shall not be stored on edge and shall be protected from dirt, water and abuse.
 - ii. Protect doors from exposure to light for veneers which are light sensitive.
 - iii. Doors shall not be subjected to extreme heat or humidity. HVAC systems should be set to provide a temperature range of 60 -90 degrees F and 25-55% relative humidity.
 - iv. Handle doors with clean hands or gloves. Do not drag doors across floors or other surfaces.
 - v. Each Door shall be marked with the opening number.
3. Pre-installation Meeting
 - i. Prior to the doors being unwrapped from the factory packaging a meeting shall take place with the factory representative or the door manufacturer and the general contractor, door distributor, installers, finishers and any other trades responsible for the handling of the doors, to review the factory Care and Handling and Finishing Instructions.
4. STC ratings shall be operable and shall have been tested and not estimated. Manufacturers shall have testing lab documentation of STC ratings.
5. Warranty: Submit in accordance with Section 01700. For factory finished or prime doors, warranty shall be in effect of the Life of the Installation for interior and interior fire.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers, subject to compliance with specifications:

1. Raydoor, New York, NY 212-421-0641, info@raydoor.com.
2. Approved equal products, subject to compliance with the design and performance of this specification and as approved by owner and architect.

2.02 DOOR CONSTRUCTION - WOOD DOORS -

A. Description:

1. Sliding pocket walls (SPW2) and sliding pocket door (SP1)
2. Veneer: 1/8" in thickness for interior.
 - i. Species: Oak
3. Size and Panel Types: See Drawings and specifications
4. Stile Thickness: 1-3/4".
5. Profiles and dimensions shall be Raydoor standards unless otherwise noted in the drawings and elevations.

B. Panel Type:

1. Beveled Panel (Panel A),
2. Panels shall be constructed of MDF core with solid wood panels laminated both sides or solid wood to match profile specified. Panels shall float inside the sticking in true stile and rail construction. Panels shall be held in place by the sticking and flexible bumper shall be installed inside sticking to keep panel centered.
3. Panel Thickness: As indicated in TruStile specifications for panel selected.

C. V Groove Series Doors:

1. Panels shall be 1/2" thick.

D. Door Top Type:

1. Square Top,
- E. Stile Construction
1. Core material to be constructed of engineered wood to resist moisture, warping, checking and improved screw pull.
 2. Stiles are to be constructed for improved screw holding by use of solid wood edges. Hardwood stiles to match face veneers.

2.03 FACTORY PREFITTING AND PREMACHINING

- A. Doors: Prefit and premachine doors at factory.
1. Obtain accurate field measurements of hardware mortised in metal frames to verify dimensions and alignment before proceeding with machining in factory.
 2. Machine doors for hardware requiring cutting of doors.
 3. Comply with accepted hardware schedules, door frame shop drawings and with hardware templates to ensure proper fit of doors and hardware.
- B. Tolerances: Comply with WDMA tolerance requirements for prefitting.

2.04 POCKET DOORS

- A. Pocket Doors shall match panel, sticking, profile and design of MDF/Wood Doors specified herein.
- B. All doors shall have hardwood wedge in the top rail of all door panels for improved screw holding and hardware attachment.
- C. Pocket Door Hardware: Manufacturer and Type: L.E. Johnson Products, Inc. Series 111FD folding door hardware set including track, hangers, hinges, pivots, knobs, brackets, screws and all other accessory items.

2.05 DOOR FABRICATION

- A. Machining for door hardware: All doors shall be machined for specified hardware that is not surface applied.
- B. Prefit and Bevel Doors 1/8" in 2 at lock stile. Ensure proper gaps are maintained on fire doors to comply with NFPA 80 requirements.
- C. Doors shall be factory glazed with glass as specified unless otherwise indicated.

2.06 FACTORY FINISHING

- A. Wood doors to be factory prefinished according to architect's instruction for color and sheen using AWI Section 1500 standards. .

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions:
 - 1 Before installation, verify that frames are proper size and type for door and are installed plumb and square as required for proper installation of doors.
 - 1. Inspect doors for any damage, manufacturing defects or prefinish inconsistency prior to installation.
 - 2. Notification: Notify General Contractor of unsatisfactory conditions in writing with copy to Architect.
- B. Acceptance: Beginning of work will indicate acceptance of existing conditions by installer.

3.02 PREPARATION

- A. Conditioning: Condition doors to average humidity in installation area prior to hanging.
- B. Prefitting: Prefit doors to frames and machine for hardware to whatever extent not previously worked at factory as required for proper fit and uniform clearance at each edge.

C. Sealing: Before installation of hardware brush apply primer to all job site cut or planed surfaces.

1. Primer: Type recommended by manufacturer.

3.03 INSTALLATION

A. General: Install doors in accordance with manufacturer's recommendations and to comply with WDMA IS 1A and NFPA 80.

1. Installation: By skilled finish carpenters or factory authorized installers.

2. Installer: Thoroughly familiar with the requirements of the manufacturer's door warranty as currently in effect and assure compliance with all provisions.

B. Hanging:

1. After sizing doors, fit for hardware as scheduled.

2. Hang doors to be free of binding with hardware functioning properly.

3.04 ADJUSTING AND PROTECTION

A. Adjustment: At completion of job, adjust doors and hardware as required and leave in proper operating condition.

B. Protection: Advise General Contractor of proper procedures required to protect installed wood doors from damages or deterioration until acceptance of entire project.

C. Replacement: Refinish or replace doors damaged during installation.

1. Causes for Rejection: Include chips, scratches or gouges.

END OF SECTION

SECTION 08333 - OVERHEAD DOORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

- A. The extent of the overhead doors is shown on the drawings.
- B. Provide complete operating door assemblies including doors, weatherstripping tracks, counterbalance mechanism, and installation accessories, as shown on the drawings and herein specified.

1.03 QUALITY ASSURANCE:

- A. Furnish each overhead door as a complete unit produced by one manufacturer, including hardware, accessories, mounting and installation components.
- B. Manufacturer: Provide rolling doors as manufactured by Overhead Door or equal as approved by Architect.
- C. Insert and Anchorages:
 - 1. Furnish inserts and anchoring devices which must be built into masonry walls for the installation of the units. Provide setting drawings, templates, instructions and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.
 - 2. See concrete and masonry sections of these specifications for installation of inserts and anchorage devices.
- D. Wind Loading:
 - 1. Design and reinforce rolling doors to withstand a 25 psf wind loading pressure with a maximum deflection of 1/120 of opening width.

1.04 SUBMITTALS:

A. Manufacturer's Data:

1. Submit manufacturer's product data, roughing-in diagrams, and installation instructions for each type and size of rolling door. Include operating instructions and maintenance information data. Transmit a copy of diagrams and installation instructions to Installer.

B. Shop Drawings:

1. Submit shop drawings for entire assembly.

PART 2 - PRODUCTS

2.01 DOOR CURTAIN MATERIALS AND CONSTRUCTION:

- A. Door Sections: Coplay, Coachman, Series 2, ARCH 1 solid, Design 22. (800-225-6729) Steel Composite overlay door with 2'' polystyrene insulation core. Sections shall be full 2'' thick roll formed from 20 ga. galvanized steel having a coating thickness of 1.25 oz. of zinc per sq. ft. Each door section to have flush outside face. End stiles to be minimum 16 ga. galvanized steel. End stiles and center stiles to be riveted to outside face. Sections shall be roll formed with tongue and groove joint for weather-tite closure between sections.
- B. Finish: Color of Door to be selected from standard colors.
- C. Tracks: 2'' galvanized finish, 1.25 oz. sq. ft. Tracks to have graduated seal for weather-tite closing. Vertical tracks shall be bracket mounted or continuous angle mounted and fully adjustable for sealing door to jamb. Continuous angle size 2-1/2'' x 4'' x 3/32'' on 2'' track. Horizontal track to be adequately reinforced with continuous angle. Installation to be low and high lift; headroom as detailed.
- D. Hardware: All hinges and brackets to be made from galvanized steel. Track rollers shall be hardened steel ball bearing, minimum 10-1/4'' balls per roller. Door shall be adequately reinforced with steel struts as required.
- E. Spring Counter Balance: Heavy duty torsion springs on continuous steel shaft. Heavy duty ball bearing brackets to support shaft. Galvanized lifting cables with minimum safety factor of 7 to 1.

- F. Lock: Exterior Locking - Five pin tumbler cylinder with nite latch and steel bar engaging track. One unit only shall have exterior lock. Interior Locking - Interior latch only. May be mounted on left or right side of door. Lock bar provided with hole to receive padlock for additional security.
- G. Weatherseal: Vinyl weatherseal to seal bottom of door to floor.
- H. Lites: None required.
- I. Accessories: Overhead Door Contractor is required to furnish and install all steel angles, supports, brackets, steel track and mounting pieces as required for jamb, head and sill complete installation of the overhead door system.
- J. Door operation to be manual operation.

2.02 PAINTING:

- A. Shop clean and prime ferrous metal and galvanized surfaces, exposed and unexposed, except faying and lubricated surfaces with door manufacturer's standard rust inhibitive primer drying to a flat sheen.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Installer must examine the substrates and conditions under which the rolling door units are to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 INSTALLATION:

- A. Install door and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports in accordance with final shop drawings, manufacturer's instructions, and as specified herein.

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- B. Upon completion of installation including work by other trades, lubricate, test and adjust doors to operate easily, free from warp, twist or distortion and fitting weathertight for the entire perimeter.

END OF SECTION 08333

SECTION 08410 - FRP DOORS-ALUMINUM FRAMING SYSTEMS

1. GENERAL

1.1. RELATED DOCUMENTS

- A. Drawings and General Provisions of contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work in this section.

1.2. DESCRIPTION OF WORK

- A. The extent of each type of door and frame is shown on the drawings and in schedules.
- B. The following types of doors and frames are required:
 - 1. FRP flush doors
 - 2. Aluminum frames for flush FRP doors.

1.3. RELATED WORK SPECIFIED ELSEWHERE

- A. For Finish Hardware, see Section 08710.
- B. For Sealants & Caulking, see Section 07920.
- C. For Glass & Glazing, see Section 08800.
- D. Aluminum Framed Entrance and Storefronts - See Section 08421

1.4. SYSTEM PERFORMANCE
FRP AND ALUMINUM FLUSH DOORS

- A. Provide door assemblies that have been designed and fabricated to comply with requirements for system performance characteristics listed below, as demonstrated by testing manufacturer's corresponding stock systems according to test methods designated.
- B. Thermal Transmission (exterior doors); U-value of not more than 0.09 (BTU/Hr. x sf x degrees F.) per AAMA 1503.01.
- C. Flame Spread/Smoke Developed: Provide FRP doors and panels with the following ratings in accordance with ASTM E 84-79a: Flame Spread: Exterior faces not greater than 145 (Class C); interior faces not greater than 10 (Class A). Smoke Developed: Exterior faces not greater than 345 (Class C); interior faces not greater than 320 (Class A).

- D. Additional Criteria: Provide FRP doors and panels with the following performance:

ASTM D 256 - nominal value of 13.5
ASTM D 1242 - nominal value of .23 percent
ASTM D 570 - nominal value of .20 to .40 percent
ASTM D 2583 - nominal value of 50

1.5. QUALITY ASSURANCE - **ALL BIDDERS SHALL BE FACTORY DIRECT AUTHORIZED DISTRIUTORS OF THE SPECIFIED PRODUCTS.**

- A. Standards: Comply with the requirements and recommendations in applicable specification and standards by NAAMM and AAMA, including the terminology definitions and specifically including the "Entrance Manual" by NAAMM, except to the extent more stringent requirements are indicated.
- B. Performance: A minimum ten year record of production of frames, doors and panels and completion of similar projects in type and size.
- C. Instruction: The manufacturer or his representative will be available for consultation to all parties engaged in the project including instruction to installation personnel.
- D. Field Measurement: Field verify all information prior to fabrication and furnish of materials. Furnish and install materials omitted due to lack of verification at no additional cost to Owner.
- E. Regulation and Codes: Comply with the current edition in force at the project location of all local, state and federal codes and regulations, including the Americans with Disabilities Act of 1992.

1.6. SUBMITTALS

- A. Product Data: Submit Manufacturer's product data, specifications and instructions for each type of door and frame required in accordance with Section 01300 and the following:
1. Include details of core, stile and rail construction, trim for lites and all other components.
 2. Include details of finish hardware mounting.
 3. Include sample of each aluminum alloy to be used on this project. Where normal finish color and texture variations

are expected, include two or more samples to show the range of such variations.

4. Include one sample of typical fabricated section, showing joints, fastenings, quality of workmanship, hardware and accessory items before fabrication of the work proceeds.

B. Submit shop drawings for the fabrication and installation of the doors and frames, and associated components. Details to be shown full scale. Include glazing details and finish hardware schedule.

1.7. PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials to jobsite in their original, unopened packages with labels intact. Inspect materials for damage and advise manufacturer immediately of any unsatisfactory materials.

B. Package door assemblies in individual corrugated cartons so no portion of the door has contact with the outer shell of the container. Package and ship frames preassembled to the greatest possible extent.

1.8. PROJECT WARRANTY

A. Provide a written warranty signed by manufacturer, installer and contractor, agreeing to replace, at no cost to the Owner, any doors, frames or factory hardware installation which fail in materials or workmanship, within the warranty period. Failure of materials or workmanship includes: excessive deflection, faulty operation of entrances, deterioration of finish, or construction in excess of normal weathering and defects in hardware installation. The minimum time period of warranty is ten (10) years from acceptance.

2. PRODUCTS

2.1. ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of the following:
1. Special-Lite, Inc., Decatur, Michigan.

2.2. MATERIALS AND ACCESSORIES

A. Aluminum Members: Alloy and temper as recommended by manufacturer for strength, corrosion resistance and application

of required finish and control of color; ASTM B 221 for extrusions, ASTM B 209 for sheet/plate with aluminum wall thickness of 0.125".

- B. Components: Furnish door and frame components from the same manufacturer. "Splitting" of door and frame components is not permitted.
- C. Fasteners: Aluminum non-magnetic stainless steel or other non-corrosive metal fasteners, guaranteed by the manufacturer to be compatible with the doors, frames, stops, panels, hardware, anchors and other items being fastened. For exposed fasteners (if any) provide oval Phillips head screws with finish matching the item to be fastened.
- D. Glazing Gaskets: For glazing factory-installed glass, and for gaskets which are factory-installed in "captive" assembly of glazing stops. Manufacturer's standard stripping of molded neoprene, complying with ASTM D 2000 (Designation 2BC415 to 3BC620), or molded PVC complying with ASTM C 509 Grade 4.

2.3. FABRICATION

- A. Sizes and Profiles: The required sizes for door and frame units, and profile requirements are shown on the drawings.
- B. Coordination of Fabrication: Field measure before fabrication, and show recorded measurements on final shop drawings.
- C. Complete the cutting, fitting, forming, drilling and grinding of all metal work prior to assembly. Remove burrs from cut edges, and ease edges and corners to a radius of approximately 1/64".
- D. No welding of doors or frames is acceptable.
- E. Maintain continuity of line and accurate relation of planes and angles. Secure attachments support at mechanical joints, with hairline fit at contacting members.
- F. Attachment of all hardware shall be made using machine screws which are supplied by the manufacturer.
- G. All holes shall be drilled and tapped using the recommended drill size for the tap required.
- H. Frames stops shall be applied stops, Minimum 5/8" high x

Minimum 1 ¼'' wide.

- I. Door attachment points shall be minimum of 1/8'' thickness.
- J. Where hardware is to be attached to frame stop (Example: exit device strike, door closer shoe, O.H. stop & Etc.) a piece of solid bar stock aluminum sized to fill the frame stop void x 18'' long shall be securely attached to the frame tube.
- K. Where it is practical to have solid bar stock reinforcement at attachment points, use ''RIV-NUTS for attachment of hardware items.

2.4. FIBERGLASS REINFORCED POLYESTER FRP FLUSH DOORS

A. Materials and Construction

1. Construct 1 ¾ inch thickness doors of 6063 T5 aluminum alloy stiles and rails minimum 25/16 inch dept. Provide joinery of 3/8 inch diameter full width tie rods through extruded splines top and bottom as standard .125 inch tubular shaped stiles and rails reinforced to accept hardware as specified.
2. Extrude top and bottom rail legs for interlocking continuous rail rigidity weather bar. Lock face sheet material in place with extruded interlocking edges to be flush with aluminum stiles and rails.
3. Door face sheeting. Spec Lite 3, 120 inch thickness fiber glass reinforced polyester. SL17 doors with pebble-like embossed pattern. Color: As selected by the Architect.
4. Core of Door Assembly: Minimum five pounds per cubic foot density poured-in-place polyurethane free of CFC and HCFC. Minimum ''R'' value of 11. Ballistic rating is as indicated. Meeting stiles on pairs of doors and weather bars with nylon brush weather-stripping.
5. Manufacture doors with cutouts for visor-lites, louvers or panels as scheduled. Factory furnish and install all glass, louvers and panels prior to shipment.
6. Premachine doors in accordance with templates from the specified hardware manufacturers and approved hardware schedule. Factory install hardware.
7. Furnish FRP doors with flush pull SL86. Color as selected by the Architect.

8. Provide door with adjustable brush insert.

2.5. ALUMINUM FRAMING SYSTEMS (For flush FRP doors)

A. Tubular Framing

1. Framing system from the door manufacturer of the size and type shown. .125" minimum wall thickness and type 6063-T5 aluminum alloy .625" high applied stops with screws and weather-stripping. Frame members are to be box type with four (4) enclosed sides. Open back framing will not be acceptable.
2. Caulk joints before assembling frame members. Secure joints with fasteners and provide a hairline butt joint appearance. Prefit doors to frame assembly at factory prior to shipment. Field fabrication of framing using "stick" material is not acceptable.
3. Applied stops for side, transom and borrowed lites and panels, with fasteners exposed on interior or unsecure portion only. Premachine and reinforce frame members for hardware in accordance with manufacturer's standards and the approved hardware schedule. Factory install hardware.
4. Anchors appropriate for wall conditions to anchor framing to wall materials. A minimum of five anchors up to 7'4" on jamb members, and one additional anchor for each foot over 7'4". Secure head and sill members of transom, sidelites and similar conditions.
5. Factory pre-assemble sidelites to the greatest extent possible, and mark frame assemblies according to location.
6. Refer to Section 08710 for removable mullions which shall be furnished and installed by this Contractor. Finish of removable mullions to match frames.

2.6. GLAZING

A. Design system for replacement of glass.

1. Manufacturer's standard flush glazing system of recessed channels and captive glazing gaskets or applied stops as shown.
2. Allow for thermal expansion on exterior units.

3. Glass as shown and factory glazed into doors.
4. Provide 1'' insulated low ''E'' glass units. Refer to Spec Section 08800 for additional information.

2.7 ALUMINUM FINISHES

- A. All exposed aluminum to be factory finished with AZKO Nobel ''Trinar'', color to be determined from manufacturer's standard and/or custom colors by Architect.

3. EXECUTION

3.1. INSTALLATION

- A. Comply with manufacturer's recommendations (maintain 3/16'' gap between leafs of pairs of doors) and specifications for the installation of the doors and frames. Factory install hardware, glass and louvers in doors. Factory assemble sidelites and transoms to the greatest extent possible.
- B. Set units plumb, level and true to line, without warp or rack of doors or frames. Anchor securely in place. Separate aluminum and other metal surfaces with bituminous coatings or other means as approved by architect.
- C. Set thresholds in a bed of mastic and backseal.
- D. Clean surfaces promptly after installation of doors and frames, exercising care to avoid damage to the protective coatings.
- E. Ensure that the doors and frames will be without damage or deterioration (other than normal weathering) at the time of acceptance.
- F. Provide Owner with all adjustment tools and instruction sheets. Arrange an inservice session to Owner at Owner's convenience. Any workmanship which is defective or deficient shall be corrected to the Owner's satisfaction and at no additional cost to the Owner per Paragraph 1.8 Project Warranty of this specification.

END OF SECTION 08410

SECTION 08520 - ALUMINUM WINDOWS-CASEMENT WINDOW

Part 1 General

1.1 Section Includes

- A. Aluminum Clad Wood Ultimate Casement Crank Out: Operators, Stationary and Picture units complete with hardware, glazing, weather strip, insect screen, jamb extension, and standard or specified anchors, trim and attachments

1.2 Related Sections

- A. Section 06100 - Carpentry: Wood trim other than furnished by window manufacturer
- B. Section 09720 - Joint Sealant: Sill sealant and perimeter caulking
- C. Section 09900 - Painting: Paint and stain other than factory applied finish

1.3 References

- A. American Society for Testing Materials (ASTM):
 - 1. E 283: Standard Test method for Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors
 - 2. E 330: Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls and Door by Uniform Static Air Pressure Difference
 - 3. E 547: Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Cyclic Static Air Pressure Differential

4. E 2190: Specification for Sealed Insulated Glass Units
 5. C 1036: Standard Specification for Flat Glass
 6. F 2090-10: Standard Specifications for Windows Fall Prevention Devices with Emergency Escape (egress) Release Mechanisms
- B. American Architectural Manufacturer's Association/Window and Door Manufacturer's Association (AAMA/WDMA/CSA):
1. AAMA/WDMA/CSA 101/I.S.2/A440-05 Standard/Specification for Window, Skylights and Doors
 2. AAMA/WDMA/CSA 101/I.S.2/A440-08, NAFS - North American Fenestration Standard/Specification for Windows, Doors and Skylights
 3. AAMA/WDMA/CSA 101/I.S.2/A440-11, NAFS 2011 - Northern American Fenestration Standard/Specification for Windows, Doors and Skylights
- C. WDMA I.S.4: Industry Standard for Water Repellant Preservative Treatment for Millwork
- D. Window and Door Manufacturer's Association (WDMA):
101/I.S.2 WDMA Hallmark Certification Program
- E. Sealed Insulating Glass Manufacturer's Association/Insulating Glass Certification Council (SIGMA/IGCC)
- F. American Architectural Manufacturer's Association (AAMA):
2605: Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels
- G. National Fenestration rating Council (NFRC):
1. 101: Procedure for Determining Fenestration Product thermal Properties

2. 200: Procedure for Determining Solar Heat Gain
Coefficients at Normal Incidence

1.4 Submittals

- A. Shop Drawings: Submit shop drawings for review.
- B. Product Data: Submit catalog data for review.
- C. Samples:
 - 1. Submit corner section for review.
 - 2. Include glazing system, quality of construction and specified finish
- D. Quality Control Submittals: Certificates: submit manufacturer's certification indicating compliance with specified performance and design requirements.

1.5 Delivery

- A. Deliver in original packaging and protect from weather

1.6 Storage and Handling

- A. Prime and seal wood surfaces, including to be concealed by wall construction, if more than thirty (30) days will expire between delivery and installation
- B. Store window units in an upright position in a clean and dry storage area above ground to protect from weather.

1.7Warranty

Complete and current warranty information is available at marvin.com/warranty. The following summary is subject to the terms, condition, limitations and exclusions set forth in the Marvin Windows and Door Limited Warranty and Products in Coastal Environments Limited Warranty Supplement:

- A. Clear insulating glass with stainless steel spacers is warranted against seal failure caused by manufacturing defects and resulting in visible obstruction through the glass for twenty (20) years from the original date of purchase. Glass is warranted against stress cracks caused by manufacturing defects from ten (10) years from the original date of purchase.
- B. Standard exterior aluminum cladding finish is warranted against manufacturing defects resulting in chalk, fade and loss of adhesion (peel) per the American Architectural Manufacturer's Association (AAMA) Specification 2605-11 Section 8.4 and 8.9 for twenty (20) years from the original date of purchase.
- C. Factory-applied interior finish is warranted to be free from finish defects for a period of five (5) years from the original date of purchase.
- D. Hardware and other non-glass components are warranted to be free from manufacturing defects for ten (10) years from the original date of purchase.

Part 2 Products

2.1Manufactured Units

A. Description: Factory-assembled Aluminum Clad Ultimate Casement, operating exterior swing window on Casement as manufactured by Marvin Windows and Doors, Warroad, Minnesota.

1. Available in 3, 4, 5 and 6 wide assemblies
2. 6 degree angle
3. With and w/out head and seat board

2.2Frame Description

A. Interior: Non Finger-Jointed White Oak with non finger-jointed Oak veneer.

1. Kiln-dried to moisture content no greater than twelve (12) percent at the time of fabrication

2. Water repellent preservative treated in accordance with WDMA I.S.4.

B. Frame exterior aluminum clad with 0.050 inch (1.3mm) thick extruded aluminum

C. Frame thickness: 1 3/16" (30mm)

D. Frame depths for full frame units have an overall 5 21/32" jamb (144mm). 4 9/16" (116mm) jamb depth from the nailing fin plane to the interior face of the frame for new construction.

E. Frame depth for replacement frame units have an overall 3 1/4" jamb (83mm) for replacement application and 2 3/16" (56mm) jamb depth from the nailing fin plane to the interior face of the frame for new construction

F. Frame bevel: Standard is no bevel, optional available are 8 degree and 14 degree bevel (Replacement frame only)

G. In-Sash Casement Polygon: minimum frame angle 15° , minimum short leg of Rough Opening 6" (152mm)

2.3 Sash Description

1. Interior: Non Finger-Jointed White Oak with non finger-jointed Oak veneer.
 2. Kiln-dried to moisture content no greater than twelve (12) percent at the time of fabrication
 3. Water repellent preservative treated with accordance with WDMA I.S.4
- H. Sash exterior aluminum clad with 0.050" (1.3mm) thick extruded aluminum
- I. Sash thickness: 1 5/8" (41mm) and 1 7/8" (48mm) for full frame units. Replacement frame will have a sash thickness of 1 5/8" (41mm).
- J. Stiles and Rails: 2 1/16" (52mm)
- K. Sash Option: Optional tall bottom rail: 3 9/16" (90mm)
- L. Interior Sash Sticking
1. Standard is: Ogee

2.4 Glazing

- A. Select quality complying with ASTM C 1036. Insulating glass SIGMA/IGCC certified to performance level CBA when tested in accordance with ASTM E 2190
- B. Glazing method: Insulating glass
- C. Glazing seal: Silicone bedding at interior and exterior

D. Insulating glass will be altitude adjusted with capillary tubes for higher elevations. Argon gas is not available for elevations that require capillary tubes

E. Glass Type: Bronze, Tempered, Low E1 with Argon.

2.5 Finish

A. Exterior: Aluminum clad. Fluoropolymer modified acrylic topcoat applied over primer. Meets or exceeds AAMA 2605 requirements.

1. Aluminum clad color options: Bahama Brown, Bronze, Cadet Gray, Cascade Blue, Cashmere, Clay, Coconut Cream, Ebony, Evergreen, Gunmetal, Hampton Sage, Pebble Gray, Sierra White, Stone White, Suede, Wineberry, Bright Silver (pearlescent), Copper (pearlescent), Liberty Bronze (pearlescent). Color to be selected by Owner.

B. Interior Finish options:

1. Prime: Factory-applied enamel primer. Available on Pine product only. Meets WDMA TM-11 requirements.

2. Factory-applied water-borne urethane stain. Stain applied over a wood (stain) conditioner. A water-borne acrylic enamel clear coat applied in two separate coats, with light sanding between coats, applied over the stain. Available on Pine, Mahogany, Mixed Grain Douglas Fir, Vertical Grain Douglas Fir, Cherry, White Oak. Colors available: Wheat, Honey, Hazelnut, Leather, Cabernet, and Espresso. Meets WDMA TM-14 requirements. Color to be selected by Owner.

2.6 Hardware

A. Casement operating hardware:

1. Locks: Multi-point sequential concealed locking system in the jamb opposite the hinge side for casement units. Lock handles are removable, non-handed and are available in the same finishes as the handles. Standard tie bars, cams and keepers - steel coated with E-Gard™. Keeper features a roller for reduce average lock force and does not easily disengage with the cam even under severe loading. Stainless steel packages are available for coastal application.
2. Handles: Standard operating handle is a folding handle, zinc painted with the standard folding cover being molded plastic. Available colors: standard is Satin Taupe (painted), White (painted), Bronze (painted), Matte Black (painted), Satin Chrome (plated), Satin Nickel (plated), Oil Rubbed Bronze (plated), Brass (plated), Antique Brass (plated)
3. Hinges: One at the sill to bottom rail, one at the head jamb to top rail. Hinges are steel coated with E-Gard™. Hinge track is stainless steel. Unit with a frame OM of 20 inches (508mm) and greater use an 18 inch (457mm) wash/egress hinge to allow the sash to slide across the frame opening which causes the sash exterior to rotate towards the user for easy wash ability. Units under a frame OM of 20 inches (508mm)width use a standard 2 bar hinge which will position the sash when fully open to 90degrees for the user to wash but does not include the feature of sliding the sash across the opening and rotating the exterior towards the user.

4. Factory Installed Window Opening Control Device (WOCD):
Minimum frame OSM 26" (660mm) x 19 ¼" (489mm); Maximum
frame OSM 40" (1016mm) x 92" (2337mm) - if frame is
less than 36" than 36" (914mm) x 96 1/8" (2442mm). WOCD
locking assembly: Factory installed. Die Cast. Color:
Satin Taupe, Bronze, White, Matte Black, Oil Rubbed
Bronze, Brass, Satin Nickel, Antique Brass, Polished
Chrome, and Satin Chrome. WOCD tether assembly: Factory
installed. Glass filled nylon. Color to be selected by
owner.

2.7 Weather Strip

- A. Weather strip at the frame is a hollow-foamed material
bent around 90 degree corner to allow for seamless corner
joints

1. Color: Beige

- B. Sash weather strip bulb shaped glass filled material

1. Color: Beige

2.8 Jamb Extension

- A. Jamb extensions are available for various wall thickness
factory-applied up to a 12 (305mm) wide

- B. Finish: Match interior frame finish

2.9 Insect Screen

- A. Crank Out

1. Aluminum frame finish is available in Satin, Bronze,
Stone White, or Ebony

2. Screen mesh: Charcoal Fiberglass, Charcoal Aluminum Wire, Black Aluminum Wire, Bright Aluminum Wire; Bright Bronze Wire, High Transparency Mesh (Hi-Tran) Charcoal Fiberglass
3. Optional Wood Screen Surround with Hi Tran Fiberglass Screen. Species will match unit species
4. Optional Retractable Wood Screen with Hi Tran Fiberglass Screen

2.10 Interior Shades

A. Cellular shade is attached to the window via a removable surround system that houses the cellular shade system and screen

1. Shade cartridge is removable and replaceable
2. Limited to 1 shade surround per sash opening
3. Interior shade has the control option of top down, bottom up

B. Surround Frame

1. Wood wrapped extruded aluminum
 - a. Species: Pine, Mahogany, Mixed Grain Douglas Fir, Vertical Grain Douglas Fir, Cherry or White Oak
 - b. Interior finishes: Bare, Prime Interior Finish (PIF), Clear Interior Finish (CIF) or Stain Interior Finish (SIF)
 - c. Roll Formed Screen: Satin Taupe (standard), White or Bronze (optional)
2. Aluminum surround and shade track
 - a. Colors: Beige, White, Bronze

3. Pull Bar: Wood wrapped extruded aluminum
 - a. End cap color will default to track color
 - b. Optional Shade Cover

C. Cellular Shade

1. Single non-fire rated hexagonal honeycomb (cellular)
3/4" (19mm)
2. Semi-Opaque Fabric (light filtering)
 - a. Colors: Driftwood, Marigold, Almond, Rose, Denim, Biscuit, Champagne, Moss, Cinnamon, Silver, White, Stone, Tan, Ivory, Eggshell
3. Opaque Fabric (Blackout)
 - a. Colors: White, Stone, Tan, Ivory, Eggshell

2.11 Accessories and Trim

A. Installation Accessories:

1. Factory-installed vinyl nailing/drip cap
2. Installation brackets: 6 3/8" (162mm), 9 3/8" (283mm), 15 3/8" (390mm)
3. Masonry brackets: 6" (152mm), 10" (254mm)

B. Installation Kit: (Venting Picture Window)

1. Units will be shipped from the factory with (2) jamb jack screws and up to 24 - #8 x3" square drive screws. The jamb jack and screws will use a number two (2) square bit. The jamb jacks shall be placed at the center span of the jambs to allow for fine tuning the installation.

C. Aluminum Extrusions:

1. Profile: Brick mold casing, flat casing, various special casing, frame expander, jamb extender, mullion cover, mullion expander, subsill, subsill end cap and lineal cap
2. Finish: Fluoropolymer modified acrylic topcoat applied over primer. Meets or exceeds AAMA 2605 requirements.
3. Available in all exterior aluminum clad colors

Part 3 Execution

3.1 Examination

- A. Verification of Condition: Before installation, verify openings are plumb, square and of proper dimensions. Report frame defects or unsuitable conditions to the General Contractor before proceeding.
- B. Acceptance of Condition: Beginning on installation confirms acceptance of existing conditions.

3.2 Installation

- C. Assemble and install window/door unit(s) according to manufacturer's instruction and reviewed shop drawing.
- D. Install sealant and related backing materials at perimeter of unit or assembly in accordance with Section 07920 Joint Sealants. Do not use expansive foam sealant.
- E. Install accessory items as required.
- F. Use finish nails to apply wood trim and mouldings.

3.3Cleaning

- A. Remove visible labels and adhesive residue according to manufacturer's instruction.
- B. Leave windows and glass in a clean condition.

3.4Protecting Installed Construction

- A. Protecting windows from damage by chemicals, solvents, paint or other construction operations that may cause damage.

End of Section

SECTION 08520 - ALUMINUM CLAD WINDOWS - DOUBLE HUNG

Part 1 General

1.1 Section Includes

- A. Aluminum Clad Wood Ultimate Double Hung - Next Generation 2.0, complete with hardware, glazing, weather strip, insect screen, , jamb extension, and standard or specified anchors, trim, attachments, and accessories

1.2 Related Sections

- A. Section 07920 - Joint Sealant: Sill sealant and perimeter caulking
- B. Section 09900 - Painting and Coasting: Paint and stain other than factory-applied finish

1.3 References

- A. American Society for Testing Materials (ASTM):
 1. E283: Standard Test method for Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors
 2. E330: Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls and Door by Uniform Static Air Pressure Difference
 3. E547: Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Cyclic Static Air Pressure Differential
 4. E2190: Specification for Sealed Insulated Glass Units
 5. C1036: Standard Specification for Flat Glass

6. E2068: Standard Test Method for Determination of Operating Force of Sliding Windows and Doors
 7. E 1996: Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Windborne Debris in Hurricanes
 8. E 1886: Standard Test method for Performance of Exterior Windows, curtain Walls, and Storm Shutters Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
 9. F 2090-10: Standard Specifications for Windows Fall Prevention Devices with Emergency Escape (egress) Release Mechanisms
- B. American Architectural Manufacturer's Association/Window and Door Manufacturer's Association (AAMA/WDMA/CSA):
1. AAMA/WDMA/CSA 101/I.S.2/A440-08, Standard/Specification for windows, doors and skylights
 2. AAMA/WDMA/CSA 101/I.S.2/A440-11, Standard/Specification for windows, doors and skylights
 3. AAMA 450-10, Voluntary Performance Rating Method for Muller Fenestration Assemblies
- C. WDMA I.S.4: Industry Standard for Water Repellant Preservative Treatment for Millwork
- D. Window and Door Manufacturer's Association (WDMA): 101/I.S.2 WDMA Hallmark Certification Program
- E. Sealed Insulating Glass Manufacturer's Association/Insulating Glass Certification Council (SIGMA/IGCC)
- F. American Architectural Manufacturer's Association (AAMA): 2605: Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels

G. National Fenestration Rating Council (NFRC):

1. 101: Procedure for Determining Fenestration Product thermal Properties
2. 200: Procedure for Determining Solar Heat Gain Coefficients at Normal Incidence

H. Window Covering Manufacturer's Association

1. A100.1: American National Standard for Safety of Corded Window Coverings Products

1.4 Submittals

- A. Shop Drawings: Submit shop drawings for review.
- B. Product Data: Submit catalog data for review.
- C. Samples:
 1. Submit corner section for review.
 2. Include glazing system, quality of construction and specified finish
- D. Quality Control Submittals: Certificates: submit manufacturer's certification indicating compliance with specified performance and design requirement.

1.5 Delivery

- A. Comply with provisions in Sections.
- B. Deliver in original packaging and protect from weather

1.6 Storage and Handling

- A. Prime and seal wood surfaces, including to be concealed by wall construction, if more than thirty (30) days will expire between delivery and installation

- B. Store window units in an upright position in a clean and dry storage area above ground to protect from weather.

1.7Warranty

Complete and current warranty information is available at marvin.com/warranty. The following summary is subject to the terms, condition, limitations and exclusions set forth in the Marvin Windows and Door Limited Warranty and Products in Coastal Environments Limited Warranty Supplement:

- A. Clear insulating glass with stainless steel spacers is warranted against seal failure caused by manufacturing defects and resulting in visible obstruction through the glass for twenty (20) years from the original date of purchase. Glass is warranted against stress cracks caused by manufacturing defects from ten (10) years from the original date of purchase.
- B. Standard exterior aluminum cladding finish is warranted against manufacturing defects resulting in chalk, fade and loss of adhesion (peel) per the American Architectural Manufacturer's Association (AAMA) Specification 2605-11 Section 8.4 and 8.9 for twenty (20) years from the original date of purchase.
- C. Factory-applied interior finish is warranted to be free from finish defects for a period of five (5) years from the original date of purchase.
- D. Hardware and other non-glass components are warranted to be free from manufacturing defects for ten (10) years from the original date of purchase.

Part 2 Products

2.1 Manufactured Units

A. Description: Aluminum Clad Ultimate Double Hung - Next Generation 2.0 (and related stationary units) as manufactured by Marvin Windows and Doors, Warroad, Minnesota.

1. Available in 3, 4, 5, and 6 wide assemblies
2. 6 degree angle
3. With and w/out head and seat board

B. Description: Aluminum Clad Ultimate Double Hung - Next Generation 2.0 Bay Assemblies as manufactured by Marvin Window and Doors, Warroad, Minnesota

1. Available 30 degree, 45 degree, and 90 degree
2. With and w/out head and seat board

2.2 Frame Description

A. Interior: Non Finger-Jointed White Oak or finger-jointed with non finger-jointed Oak veneer.

1. Kiln-dried to moisture content no greater than 12 percent at the time of fabrication
2. Water repellent, preservative treated in accordance with ANSI/WDMA I.S.4.

B. Frame exterior aluminum clad with 0.050" (1.3mm) thick extruded aluminum

C. Frame thickness: 1 25/32" (45mm) head and jambs

D. Frame depth: Frame depth had an overall 5 21/32" jamb (144mm). 4 9/16" (116mm) jamb depth from the nailing fin plane to the interior face of the frame for new construction.

E. Sill assembly including the sill liner: 2 7/32" (56mm)

2.3 Sash Description

A. Interior: Non Finger-Jointed White Oak or finger-jointed with non finger-jointed Oak veneer.

1. Kiln-dried to moisture content no greater than 12 percent at the time of fabrication

2. Water repellent preservative treated with accordance with WDMA I.S.4.

B. Sash exterior aluminum clad with 0.050" (1.3mm) thick extruded aluminum

C. Sash thickness: 1 3/4" (44mm). Corner slot and tenoned.

D. Operable sash tilt to interior for cleaning or removal

E. Sash Options: Unequal Sash

F. Exterior Cope Profile: Putty

G. Interior Sash Sticking

1. Standard: Ogee

2.4 Glazing

A. Select quality complying with ASTM C1036. Insulating glass SIGMA/IGCC certified to performance level CBA when tested in accordance with ASTM E2190.

B. Glazing method: Insulating glass

C. Glazing seal: Silicone bedding on interior and exterior

D. Glass Type: Bronze, Tempered, Low E1 with Argon

2.5 Certified Mulling

- A. Directional mull limits: 1 High (can be 2 or more units wide in an assembly)
1. Max mullion span is 71 ½" (1816mm); max tributary width 45 ¼" (1149mm)
 2. CUDH NG 2.0 to CUDH NG 2.0 only
 3. Certified to Design Pressure 50
- B. Directional mull limits: 1 Wide (can be 2 or more units high in an assembly)
1. Max mullion span is 69 ¼" (1759mm); max tributary height 53 19/32" (1361mm)
 2. CUDH NG 2.0 over CUDH NG 2.0 only
 3. Certified to Design Pressure 50
- C. Multiple Wide x Multiple High assemblies with 1" LVL
1. Max mullion span is 75 11/16" (1922mm); max tributary width is 45 1/4" (1149mm)
 2. LVL must be in vertical mull
 3. Certified to Design Pressure 50
- D. Multiple Wide x Multiple High assemblies with 3/8" (10mm) MRF
1. Max mullion span is 83 11/16" (2125mm); max tributary width 45 1/4" (1149mm)
 2. CUDH NG 2.0 over CUDH NG 2.0 only
 3. Certified to Design Pressure 65

- E. If any units have a lower design pressure the entire assembly will have the lowest design pressure of any unit or mull in the assembly.

2.6 Finish

- A. Exterior: Aluminum clad. Fluoropolymer modified acrylic topcoat applied over primer. Meets AAMA 2605 requirements.

1. Aluminum clad color options: Bahama Brown, Bronze, Cadet Gray, Cascade Blue, Cashmere, Clay, Coconut Cream, Ebony, Evergreen, Gunmetal, Hampton Sage, Pebble Gray, Sierra White, Stone White, Suede, Wineberry, Bright Silver (pearlescent), Copper (pearlescent), Liberty Bronze (pearlescent). NOTE: Color to be selected by Owner.

- B. Interior Finish options:

1. Prime: Factory-applied enamel primer. Available on Pine product only. Meets WDMA TM-11 requirements.
2. Painted Interior Finish. Available on Pine product only. Available in White or Designer Black. Meets WDMA TM-14 requirements.
3. Factory-applied water-borne acrylic enamel clear coat. Applied in two separate coats with light sanding between coats. Available on White Oak. Meets WDMA TM-14 requirements.
4. Factory-applied water-borne urethane stain. Stain applied over a wood (stain) conditioner. A water-borne acrylic enamel clear coat applied in two separate coats, with light sanding between coats, applied over the stain. Available on White Oak. Colors available: Wheat, Honey, Hazelnut, Leather, Cabernet, and Espresso. Meets WDMA TM-14 requirements. NOTE: Color to be selected by owner.

2.7 Hardware

A. Locking system that provides locking, unlocking, balancing, and tilting of the sash members

B. Lock Actuator Assembly

1. Material

a. Zinc die-cast

b. Available finishes: Satin Taupe, White, Bronze, Matte Black, Brass, Antique Brass, Polished Chrome, Satin Chrome, Oil Rubbed Bronze, or Satin Nickel. NOTE: Color to be selected by Owner.

2. Design Feature and Components

a. To unlock unit, turn the handle 135°

b. Lock automatically locks when both sash are closed.

c. To tilt the bottom sash for wash mode, the bottom sash must be unlocked and raised a few inches; push the button on top of the lock handle and rotate the handle 180°

d. To tilt the top sash for wash mode, the bottom sash must be tilted and/or removed from the frame; lower the top sash to a good working height, retract the tilt latches on the top rail and tilt sash inward out of the frame

e. Custodial hardware colors: Satin Taupe, White, Bronze

C. Latches

1. Bottom sash latch

a. Material

- i. Bolt: Glass-filled nylon
- ii. Latch housing: Acetal
- iii. Sash latch reinforcement: Stainless steel

2. Top sash tilt latch

a. Material

- i. Bolt: Glass-filled nylon
- ii. Latch housing: Glass-filled nylon

3. Latches accommodate travel of sash in frame, and tilting into wash-mode

4. Color: Beige

D. Strike Assembly

1. Material

- f. Zinc die-cast strike plate and injection-molded Acetal housing and button
- g. Available finishes: Satin Taupe, White, Bronze, Matte Black, Brass, Antique Brass, Polished Chrome, Satin Chrome, Oil Rubbed Bronze, or Satin Nickel

2. Strike assembly accommodates locking/unlocking

E. Balance System (balance system determined by sash weight)

1. Block & tackle balances

2. Hybrid spiral balances

F. Factory-applied Window Opening Control Device (WOCD) is a sash limiter that prevents the window opening more than 4" vertically. It meets ASTM F2090-10 specifications for window fall prevention standards. The system consists of two single action devices that allows for egress (when applied to an egress size window) by bypassing the 4" stop feature.

1. Material

a. WOCD device: zinc die-cast

b. WOCD strike plate: nylon

2. 2 WOCD's applied to each double and single hung window and will be recessed into the stiles of the top sash

3. Default color matches lock handle

4. Strike plate mounted to the bottom sash check rail

5. Strike plate color to match weather strip

G. Sash Limiter

1. Bottom Sash Limiter (Acetal)

a. Available on all operator configurations, and StormPlus IZ3

b. Selectable bottom sash locations, 4", 6" or 8" Net Clear Opening (NCO)

c. Non-tilt hardware is default, and a sash removal tool is required in order to by-pass the Sash limiter for sash removal (tilt wash mode)

d. Standard application is factory applied. Available for field retrofit applications.

e. Color: Will align with the Exterior Weather Strip Package selection

2. Top Sash Limiter (Extruded PVC)

- a. Available on all operator configurations, with the exception Single Hung configurations. This includes StormPlus IZ3
- b. Standard application is factory applied. Available for field applications
- c. Color: Will align with the Interior Weather Strip Package selection

H. Exterior Sash Lugs - Standard Option

1. Standard Profile: Ogee
2. Available on Top Sash
3. Color: Available in all exterior clad color options
 - a. Color shall be the same as top sash clad color. Color selected by Owner.
4. Standard application is factory applied. Available for field applications

2.8 Weather Strip

A. Operating units:

1. Jambs: Foam-filled bulb
2. Header: Continuous dual leaf
3. Bottom rail and check rail: Hollow bulb

B. Stationary units:

1. Jambs: Foam for picture units; foam-filled bulb for transom unit
2. Header and bottom rail: Hollow bulb

2.9 Jamb Extension

- A. Jamb extensions are available for various wall thickness factory-applied up to a 14" (356mm) wide
- B. Finish: Match interior frame finish. Color to be selected by Owner.

2.10 Insect Screen

- A. Factory-installed full or half screen. Half screen covers sash opening.
 - 1. Screen Mesh: Charcoal Fiberglass
 - 2. Optional Screen Mesh: Charcoal Aluminum Wire, Black Aluminum Wire, Bright Aluminum Wire, Bright Bronze Wire, Hi-Tran Fiberglass Mesh
- B. Aluminum frame finish:
 - 1. Color: Matches exterior aluminum clad color

2.11 Interior Shade

- A. Cellular shade is attached to the window with a removable surround system that houses the cellular shade system
 - 1. Minimum jamb depth: 5 13/16" (148mm)
 - 2. Shade cartridge is removable and replaceable
 - 3. Shade control: top down, bottom up
 - 4. Retractable screen option can be used in conjunction with the interior shade, minimum jamb depth: 6 9/16" (167mm)
- B. Wood wrapped extruded aluminum surround frame
 - 1. Species: Pine, Mahogany, Mixed Grain Douglas Fir, Vertical Grain Douglas Fir, Cherry, or White Oak

2. Interior finishes: Bare, Prime Interior Finish (PIF), Clear Interior Finish (CIF) or Stain Interior Finish (SIF)
3. Rolled Form Screen: Satin Taupe (standard), White or Bronze (optional)
4. Optional Shade Cover

C. Cellular Shade

1. Single non-fire rated hexagonal honeycomb (cellular) $\frac{3}{4}$ " (19mm)
2. Semi-Opaque Fabric (light filtering)
 - a. Colors: Driftwood, Marigold, Almond, Rose, Denim, Biscuit, Champagne, Moss, Cinnamon, Silver, White, Stone, Tan, Ivory, Eggshell. Color to be selected by Owner.

2.12 Accessories and Trim

A. Installation Accessories:

1. Factory-installed vinyl nailing/drip cap
2. Installation brackets: 6 $\frac{3}{8}$ " (162mm), 9 $\frac{3}{8}$ " (283mm), 15 $\frac{3}{8}$ " (390mm)
3. Masonry brackets: 6" (152mm), 10" (254mm)

B. Aluminum Extrusions:

1. Casing Profile: Brick Mould Casing (BMC), Flat Casing, Columbus Casing, Grayson Casing, Kinsley Casing, Ridgeland Casing, Stratton Casing, Thorton Casing, Potter Casing, 1 $\frac{1}{2}$ " Flat Casing.
2. Aluminum clad Extrusion: Frame Expander, Jamb Extender, Mullion Cover, Mullion Expander, Subsill, Subsill End Cap and Lineal Cap

3. Finish: Fluoropolymer modified acrylic topcoat applied over primer. Meets AAMA 2605 requirements
4. Available in all exterior aluminum clad colors

Part 3 Execution

3.1 Examination

- A. Verification of Condition: Before installation, verify openings are plumb, square and of proper dimensions as required. Report frame defects or unsuitable conditions to the General contractor before proceeding.
- B. Acceptance of Condition: Beginning on installation confirms acceptance of existing conditions.

3.2 Installation

- A. Assemble and install window/door unit(s) according to manufacturer's instruction and reviewed shop drawing.
- B. Install sealant and related backing materials at perimeter of unit or assembly in accordance with Section 07920 Joint Sealants.
- C. Install accessory items as required.
- D. Use finish nails to apply wood trim and mouldings.

3.3 Field Quality Control

- A. Remove visible labels and adhesive residue according to manufacturer's instruction.
- B. Unless otherwise specified, air leakage resistance tests shall be conducted at a uniform static pressure of 75 Pa (~1.57 psf). The maximum allowable rate of air leakage shall not exceed 2.3 L/sm² (~0.45 cfm/ft²).

C. Unless otherwise specified, water penetration resistance testing shall be conducted per AAMA 502 and ASTM E1105 at 2/3 of the fenestration products design pressure (DP) rating using "Procedure B" - cyclic static air pressure difference. Water penetration shall be defined in accordance with the test method(s) applied.

3.4 Cleaning

A. Remove visible labels and adhesive residue according to manufacturer's instruction.

B. Leave windows and glass in a clean condition.

3.5 Protecting Installed Construction

A. Protecting windows from damage by chemicals, solvents, paint or other construction operations that may cause damage.

End of Section

SECTION 08710 - FINISH HARDWARE

PART 1 - GENERAL

1.1 Refer to "General and Special Conditions", and "Instructions to Bidders", Division 1 of Specifications. Requirements of these Sections and the project drawings shall govern work in this section.

1.2 Work Included:

A. Furnish all items of Finish Hardware specified, scheduled, shown or required herein except those items specifically excluded from this section of the specification.

B. Related work:

1. Division 00 00 00 - Procurement and Contracting Requirements
2. Division 01 00 00 - General Requirements
3. Division 06 00 00 - Wood, Plastics, and Composites
4. Division 08 00 00 - Openings
5. Division 10 00 00 - Specialties
6. Division 11 00 00 - Equipment
7. Division 26 00 00 - Electrical
8. Division 27 00 00 - Communications
9. Division 28 00 00 - Electronic Safety and Security

C. Specific Omissions: Hardware for the following is specified or indicated elsewhere, unless specifically listed in the hardware sets:

1. Cabinet Hardware.
2. Signs, except as noted.
3. Folding partitions, except cylinders where detailed.
4. Sliding aluminum doors
5. Chain link and wire mesh doors and gates
6. Access doors and panels
7. Overhead and Coiling doors

1.3 Quality Assurance

A. Requirements of Regulatory Agencies:

1. Furnish finish hardware to comply with the requirements of laws, codes, ordinances, and regulations of the governmental authorities having jurisdiction where such requirements exceed the requirements of the Specifications.
2. Furnish finish hardware to comply with the requirements of the regulations for public building accommodations for physically handicapped persons of the governmental authority having jurisdiction and to comply with Americans with Disabilities Act.
3. Provide hardware for fire-rated openings in compliance with NFPA 80 and state and local building code requirements. Provide only hardware that has been tested and listed by UL for types and sizes of doors required and complies with requirements of door and door frame labels.

B. Hardware Supplier:

1. Shall be an established firm dealing in contract builders' hardware. He must have adequate inventory, qualified personnel on staff and be located within 100 miles of the project. The distributor must be a factory-authorized dealer for all materials required. The supplier shall be or have in employment an Architectural Hardware Consultant (AHC).

C. Electrified Door Hardware Supplier:

1. Shall be an experienced door hardware supplier who has completed projects with electrified door hardware similar in material, design, and extent to that indicated for this project, whose work has resulted in construction with a record of successful in-service performance, and who is acceptable to manufacturer of primary materials.
2. Shall prepare data for electrified door hardware, including shop drawings, based on testing and engineering analysis of manufacturer's standard units

in assemblies similar to those indicated for this project.

3. Shall have experience in providing consulting services for electrified door hardware installations.

D. Pre-installation Meeting:

1. Before hardware installation, General Contractor/Construction Manager will request a hardware installation meeting be conducted on the installation of hardware; specifically that of locksets, closers, exit devices, overhead stops and coordinators. Manufacturer's representatives of the above products, in conjunction with the hardware supplier for the project, shall conduct the meeting. Meeting to be held at job site and attended by installers of hardware for aluminum, hollow metal and wood doors. Meeting to address proper coordination and installation of hardware, per finish hardware schedule for this specific project, by using installation manuals, hardware schedule, templates, physical product samples and installation videos.
2. When any electrical or pneumatic hardware is specified this meeting shall also include the following trades/installers: Electrical, Security, Alarm systems and Architect.
3. Convene one week or more prior to commencing work of this Section.
4. The Hardware Supplier shall include the cost of this meeting in his proposal.

E. Manufacturer:

1. Obtain each type of hardware (latch and locksets, hinges, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.
2. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.

1.4 Submittals:

A. Hardware Schedule

1. Submit number of Hardware Schedules as directed in Division 1.
2. Follow guidelines established in Door & Hardware Institute Handbook (DHI) Sequence and Format for the Hardware Schedule unless noted otherwise.
3. Schedule will include the following:
 - a. Door Index including opening numbers and the assigned Finish Hardware set.
 - b. Preface sheet listing category only and manufacturer's names of items being furnished as follows:

CATEGORY	SPECIFIED	SCHEDULED
Hinges	Manufacturer A	Manufacturer B
Lock sets	Manufacturer X	Manufacturer X
Kick Plates	Open	Manufacturer Z

- c. Hardware Locations: Refer to Article 3.1 B.2 Locations.
- d. Opening Description: Single or pair, number, room locations, hand, active leaf, degree of swing, size, door material, frame material, and UL listing.
- e. Hardware Description: Quantity, category, product number, fasteners, and finish.
- f. Headings that refer to the specified Hardware Set Numbers.
- g. Scheduling Sequence shown in Hardware Sets.
- h. Product data of each hardware item, and shop drawings where required, for special conditions and specialty hardware.
- i. Electrified Hardware system operation description.
- j. "Vertical" scheduling format only. "Horizontal" schedules will be returned "Not Approved."
- k. Typed Copy.
- l. Double-Spacing.

- m. 8-1/2 x 11 inch sheets
- n. U.S. Standard Finish symbols or BHMA Finish symbols.

B. Product Data:

- 1. Submit, in booklet form Manufacturers Catalog cut sheets of scheduled hardware.
- 2. Submit product data with hardware schedule.

C. Samples:

- 1. Prior to submittal of the final hardware schedule and prior to final ordering of finish hardware, submit one sample, if required, of each type of exposed hardware unit, finished as required and tagged with full description for coordination with schedule.
- 2. Samples will be returned to the supplier. Units, which are acceptable and remain undamaged through submittal, review and field comparison procedures may, after final check of operation, be used in the work, within limitations of keying coordination requirements.

D. Key Schedule:

- 1. Submit detailed schedule indicating clearly how the Owner's final keying instructions have been followed.
- 2. Submit as a separate schedule.

E. Electrified Hardware Drawings:

- 1. Submit elevation drawings showing relationship of all electrical hardware components to door and frame. Indicate number and gage of wires required.
 - a. Include wiring drawing showing point to point wire hook up for all components.
 - b. Include system operations descriptions for each type of opening; describe each possible condition.

F. Submit to General Contractor/Construction Manager, the factory order acknowledgement numbers for the various hardware items to be used on the project. The factory order acknowledgement numbers shall help to facilitate and expedite any service that may be required on a particular

hardware item. General Contractor/Construction Manager shall keep these order acknowledgement numbers on file in the construction trailer.

1.5 Product Delivery, Storage, and Handling:

- A. Label each item of hardware with the appropriate door number and Hardware Schedule heading number, and deliver to the installer so designated by the contractor.

1.6 Existing Conditions:

- A. Where existing doors, frames and/or hardware are to remain, conditions, preparations and functions shall be field verified to confirm compatibility with specified hardware. Where any incompatibility is discovered, notify the contractor or construction manager immediately and provide a suggested solution based on industry standard business practices.

1.7 Warranties:

- A. Refer to Division 1 for warranty requirements.

- B. Special Warranty Periods:

- 1. Closers shall carry manufacturer's 30-year warranty against manufacturing defects and workmanship.
- 2. Locksets shall carry manufacturer's 3-year warranty against manufacturing defects and workmanship.
- 3. Continuous gear hinges shall carry manufacturer's lifetime warranty to be free from defects in material and workmanship.
- 4. Balance of items shall carry a manufacturer's 1-year warranty against manufacturing defects and workmanship.

- C. During the warranty period, replace defective work, including labor, materials and other costs incidental to the work.

PART 2 - PRODUCT

- 2.1 Furnish each category with the products of only one manufacturer unless specified otherwise; this requirement is mandatory whether various manufacturers are listed or not.
- 2.2 Provide the products of manufacturer designated or if more than one manufacturer is listed, the comparable product of one of the other manufacturers listed. Where only one manufacturer or product is listed, it is understood that this is the owner's Building Standard and "no substitution" is allowed.
- A. Hinges:
1. Furnish hinges of class and size as listed in sets.
 2. Numbers used are Ives (IVE).
 3. Products of a BHMA member are acceptable.
- B. Continuous Gear Hinge:
1. 6063-T6 aluminum alloy, anodized finish (cap on entire hinge painted if specified). Manufacture to template, uncut hinges non-handed, pinless assembly, three interlocking extrusions, full height of door and frame, lubricated polyacetal thrust bearing, fasteners 410 stainless steel plated and hardened. All hinge profiles to be manufactured to template bearing locations, with standard duty bearing configurations at 5-1/8" spacing with a minimum of 16 bearings: and heavy duty at 2-9/16" spacing with a minimum of 32 bearings. Anodizing of material shall be done after fabrication of components so that all bearing slots are anodized.
 2. Length: 1" less than door opening height. Fastener 12-24 x 1/2" #3 Phillips keen form stainless steel self-tapping at aluminum and hollow metal doors, 12- 1/2" #3 Philips, flathead full thread at wood doors.
 3. Furnish fire rated hinges "FR" at labeled openings.

4. Numbers used are Ives.
 - a. For Wood and Hollow Metal frames;
 - 1) Ives 224HD
 - 2) Equal products by Hager & Select will also be accepted.
 - b. For Aluminum frames;
 - 1) Ives 112HD
 - 2) Equal products by Hager & Select will also be accepted.

C. Flush Bolts:

1. Manual - wood and metal doors:
 - a. Ives FB458 Series
 - b. Equal product of any B.H.M.A. member.
2. Dust Proof Strikes - furnish with all flush bolts, except at openings having thresholds:
 - a. Ives DP2
 - b. Equal product of any B.H.M.A. member.

D. Locksets and Latchsets - Heavy Duty Cylindrical Type:

1. Function numbers listed are Schlage.
2. Provide 2-3/4 inch backset.
3. Provide strikes with extended lips where required to protect trim from being marred by latch bolt. Provide strike lips that do not project more than 1/8" beyond doorframe trim at single doors and have 7/8" lip to center at pairs of 1-3/4" doors.
4. Locksets and Latchsets:
 - a. Schlage ND
5. Lockset Trim:
 - a. Schlage Sparta

E. Exit Devices

1. All exit devices shall meet ANSI A156.3, 1994, Grade 1 test standards.
2. Devices shall be push through type with stainless steel touch pad design.
3. Center Case: Shall be interchangeable with all functions.
4. Mechanism End Cap: Shall be a stamped or forged metal. Plastic end caps will not be acceptable.

5. Trim: Shall be heavy-duty type.
6. The following manufacturers will be acceptable providing they meet the above criteria for exit devices:
 - a. Falcon 24/25 Series
7. Trim:
 - a. As specified in sets.
 - b. Levers to match lockset design where specified.

F. Push and Pull Hardware:

1. Push-Pull Units: One inch round rod. Push: Straight push bar, Pull: 90 degree offset, 12 inch centers. Attach top post of pull back to back with latch stile end of push bar, bottom post of pull and hinge stile end of push bar with end caps.
2. Pull, Offset: One inch round rod, 90 degree offset, 12 inch centers.
3. Manufacturer: Provide push and pull hardware from any member of B.H.M.A.

G. Closers

1. Refer to door and frame details and furnish accessories such as drop plates, panel adapters, spacers and supports as required to correctly install door closers. State degree of door swing in the hardware schedule.
2. Acceptable manufacturers and types:
 - a. LCN Series as listed in sets.

H. Overhead Holders and Stops:

1. Type, function and fasteners must be same as Glynn-Johnson specified. Size per manufacturer's selector chart. Plastic end caps, hold open mechanisms and shock blocks are not allowed. End caps must be finished same as balance of unit.
2. Manufacture products using base material of Brass/Bronze for US3, US4, & US10B finished products and 300 Stainless Steel for US32 & US32D finished products.

3. Type, function, and fasteners must be the same as Glynn-Johnson specified. Size per manufacturer's selector chart.
 - a. Glynn-Johnson

I. Kick Plates:

1. Furnish .050 inches thick, beveled four sides, countersunk fasteners, 10" high x door width less 2" at single doors and less 1" at pairs. Where glass or louvers prevent this height, supply with height equal to height of bottom rail less 2".
2. Any BHMA manufacturing product meeting above is acceptable.

J. Bumpers:

1. Wrought, forged, or cast, approximately 2-1/2 inch diameter, convex or concave rubber center, concealed fasteners.
 - a. Ives WS406/WS407 Series
 - b. BHMA L02101.

K. Wall Stops:

1. Length to exceed projection of all other hardware. Provide with threaded studs and expansion shields for masonry wall construction.
 - a. Ives WS447
 - b. BHMA L12011 or L12021

L. Wall Holders:

1. Products specified by series only; furnish strike length to exceed projection of all other hardware.
 - a. Ives WS40
 - b. Equal products of any BHMA manufacturer

M. Thresholds:

1. 1/2" high - 5" wide. Cope at jambs.
2. Furnish full wall opening width when frames are recessed.

3. Cope in front of mullions if thresholds project beyond door faces.
4. Furnish with non-ferrous Stainless Steel Screws and Lead Anchors.
 - a. National Guard as listed in sets
 - b. Equal of Zero or Reese

N. Door Sweeps:

1. Surface Sweeps:
 - a. National Guard as listed in sets
 - b. Equal by Zero or Reese

O. Weather Seal:

1. Apply to head and jamb stops.
2. Solid Bar stock all sides
 - a. National Guard as listed in sets
 - b. Equal by Zero or Reese

P. Miscellaneous:

1. Furnish items not categorized in the above descriptions but specified by manufacturer's names in Hardware Sets.

Q. Fasteners:

1. Furnish fasteners of the proper type, size, quantity and finish. Use machine screws and expansion shields for attaching hardware to concrete or masonry, and wall grip inserts at hollow wall construction. Furnish machine screws for attachment to reinforced hollow metal doors and frames and reinforced aluminum doors and frames. Furnish full thread wood screws for attachment to solid wood doors and frames. "TEK" type screws are not acceptable.
2. **Sex bolts will not be permitted on reinforced metal doors or wood doors where blocking is specified.**

2.3 Finishes:

- A. Generally, Dull Chrome, US26D / BHMA 626. Provide finish for each item as indicated in sets.

2.4 Templates and Hardware Location:

- A. Furnish hardware made to template. Supply required templates and hardware locations to the door and frame manufacturers.
- B. Furnish metal template to frame/door supplier for continuous hinge.
- C. Refer to Article 3.1 B.2, Locations, and coordinate with templates.

2.5 Cylinders and Keying:

- A. All cylinders for this project will be supplied by one supplier regardless of door type and location.
- B. The Finish Hardware supplier will meet with Architect and/or Owner to finalize keying requirements and obtain keying instructions in writing.
 - 1. Supplier shall include the cost of this service in his proposal.
- C. Provide a cylinder for all hardware components capable of being locked.
- D. Provide cylinders master and grand master keyed to new Schlage system according to Owner's instructions. Provide change keys, master keys and grand master keys as required by Owner.
- E. Provide cylinders with construction cores or keying for use during the construction period. When so directed, and in the presence of the Owner's security department or representative, convert construction cores or keying to the final system.
 - 1. Supplier shall include the cost of this service in his proposal.

PART 3 - EXECUTION

3.1 Installation

A. General:

1. Install hardware according to manufacturers installations and template dimensions. Attach all items of finish hardware to doors, frames, walls, etc. with fasteners furnished and required by the manufacture of the item.
2. Provide blocking/reinforcement for all wall mounted Hardware.
3. Reinforced hollow metal doors and frames and reinforced aluminum door and frames will be drilled and tapped for machine screws.
4. Solid wood doors and frames: full thread wood screws. Drill pilot holes before inserting screws.
5. Continuous gear hinges attached to hollow metal doors and frames and aluminum doors and frames: 12-24 x 1/2" #3 Phillips Keenform self-tapping. Use #13 or 3/16 drill for pilot.
6. Continuous Gear Hinges require continuous mortar guards of foam or cardboard 1/2" thick x frame height, applied with construction adhesive.
7. Install weather-strip gasket prior to parallel arm closer bracket, rim exit device or any stop mounted hardware. Gasket to provide a continuous seal around perimeter of door opening. Allow for gasket when installing finish hardware. Door closers will require special templating. Exit devices will require adjustment in backset.

B. Locations:

1. Dimensions are from finish floor to center line of items.
2. Include this list in Hardware Schedule.

<u>CATEGORY</u>	<u>DIMENSION</u>
Hinges	Door Manufacturer's Standard
Flush Bolt Levers	72" and 12"
Levers	Door Manufacturer's Standard
Exit Device Touchbar	Per Template
Push-Pull Units	42" to centerline of Pull
Offset Pulls	Suitable for Exit Devices
Wall Stops/holders	At Head

C. Field Quality Inspection:

1. Inspect material furnished, its installation and adjustment, and instruct the Owner's personnel in adjustment, care and maintenance of hardware.
2. Locksets and exit devices shall be inspected after installation and after the HVAC system is in operation and balanced, to insure correct installation and proper operation.
3. Closers shall be inspected and adjusted after the HVAC system is in operation and balanced, to insure correct installation and proper operation.
4. A written report stating compliance, and also locations and kinds of noncompliance shall be forwarded to the Architect with copies to the Contractor, hardware distributor, hardware installer and building owner.

D. Technical and Warranty Information:

1. At the completion of the project, the technical and warranty information coalesced and kept on file by the General Contractor/Construction Manager shall be given to the Owner or Owner's Agent. In addition to both the technical and warranty information, all factory order acknowledgement numbers supplied to the General Contractor/Construction Manager during the construction period shall be given to the Owner or Owner's Agent. The warranty information and factory order acknowledgement numbers shall serve to both expedite and properly execute any warranty work that may be required on the various hardware items supplied on the project.
2. Submit to General Contractor/Construction Manager, two copies each of parts and service manuals and two each of any special installation or adjustment tools. Include for locksets, exit devices, door closers and any electrical products.

3.2 Hardware Sets:

HARDWARE SET NO. 01

EACH TO HAVE:

3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	SET	PUSH/PULL BAR	9190HD-12"-NO	630	IVE
1	EA	SURFACE CLOSER	4050 SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE

HARDWARE SET NO. 02

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE LOCK	ND53PD SPA	626	SCH
1	EA	SURFACE CLOSER	1450 CUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE

HARDWARE SET NO. 03

EACH TO HAVE:

6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
2	EA	ROLLER LATCH	RL32	626	IVE
2	EA	DOOR PULL, 3/4" RND	8102HD 6" STD	630	IVE
2	EA	OH STOP	450S	652	GLY

HARDWARE SET NO. 04

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50PD SPA	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE

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HARDWARE SET NO. 05

EACH TO HAVE :

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80PD SPA	626	SCH
1	EA	OH STOP	450S	652	GLY

HARDWARE SET NO. 06

EACH TO HAVE :

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80PD SPA	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE

HARDWARE SET NO. 07

EACH TO HAVE :

2	EA	CONT. HINGE	112HD	710	IVE
1	EA	REMOVABLE MULLION	4023	USP	FAL
1	EA	PANIC HARDWARE	24-R-EO	313	FAL
1	EA	PANIC HARDWARE	24-R-NL-OP	313	FAL
1	EA	RIM CYLINDER	20-022	613	SCH
2	EA	90 DEG OFFSET PULL	8190HD 12" O	613	IVE
2	EA	SURFACE CLOSER	4050 SCUSH	695	LCN
1	SET	WEATHER SEAL (BY DOOR & FRAME MFR)			
2	EA	DOOR SWEEP	8198D	D	ZER
1	EA	THRESHOLD	545D-MSLA-10	D	ZER

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HARDWARE SET NO. 08

EACH TO HAVE:

1	EA	CONT. HINGE	112HD	710	IVE
1	EA	VANDL STOREROOM LOCK	ND96PD SPA	613	SCH
1	EA	SURFACE CLOSER	4050 HW/PA (MOUNT PULL SIDE)	695	LCN
1	EA	WALL STOP	WS406/407CCV	613	IVE
1	SET	WEATHER SEAL	(BY DOOR & FRAME MFR)		
1	EA	DOOR SWEEP	8198D	D	ZER
1	EA	THRESHOLD	545D-MSLA-10	D	ZER

HARDWARE SET NO. 09

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S SPA	626	SCH
1	EA	OH STOP	450S J	652	GLY

HARDWARE SET NO. 10

EACH TO HAVE:

3	EA	HW HINGE	5BB1HW 4.5 X 4.5	630	IVE
1	EA	PRIVACY LOCK	ND40S SPA	626	SCH
1	EA	SURFACE CLOSER	1450 RW/PA (MOUNT PULL SIDE)	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S-BK	S-BK	ZER

HARDWARE SET NO. 11

EACH TO HAVE:

* ALL HDWE BY THE DOOR MFR
*

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HARDWARE SET NO. 12

EACH TO HAVE :

2	EA	CONT. HINGE	112HD	710	IVE
2	EA	MANUAL FLUSH BOLT	FB458	613	IVE
1	EA	VANDL STOREROOM LOCK	ND96PD SPA	613	SCH
2	EA	OH STOP & HOLDER	90H	613	GLY
1	EA	SURFACE CLOSER	4050 SHCUSH SRI	695	LCN
1	SET	WEATHER SEAL	(BY DOOR & FRAME MFR)		
2	EA	DOOR SWEEP	8198D	D	ZER
1	EA	THRESHOLD	545D-MSLA-10	D	ZER

HARDWARE SET NO. 13

EACH TO HAVE :

1	EA	CONT. HINGE	112HD	710	IVE
1	EA	VANDL STOREROOM LOCK	ND96PD SPA	613	SCH
1	EA	SURFACE CLOSER	4050 SHCUSH SRI	695	LCN
1	SET	WEATHER SEAL	(BY DOOR & FRAME MFR)		
1	EA	DOOR SWEEP	8198D	D	ZER
1	EA	THRESHOLD	545D-MSLA-10	D	ZER

HARDWARE SET NO. 14

EACH TO HAVE :

1	SET	POCKET DOOR HDWE	100PDSC		JOH
2	EA	DOOR EDGE PULL	230	626	IVE
4	EA	FLUSH PULL	962	626	IVE

HARDWARE SET NO. 15

EACH TO HAVE :

1	SET	POCKET DOOR HDWE	100PDSC		JOH
1	EA	DOOR EDGE PULL	230	626	IVE
2	EA	FLUSH PULL	962	626	IVE

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HARDWARE SET NO. 16

EACH TO HAVE :

1	EA	CONT. HINGE	112HD	710	IVE
1	EA	CYLINDER DEAD LOCK	L9464P LLL 17B L583-363 L283-150 XL11-886	613	SCH
1	EA	CONCEALED PULL	(BY DOOR MFR)		
1	EA	SURFACE CLOSER	4050 HW/PA (MOUNT PULL SIDE)	695	LCN
1	EA	WALL STOP	WS406/407CCV	613	IVE
1	SET	WEATHER SEAL	(BY DOOR & FRAME MFR)		
1	EA	DOOR SWEEP	8198D	D	ZER
1	EA	THRESHOLD	545D-MSLA-10	D	ZER

MOUNT THE CONCEALED DOOR PULL ON THE PUSH SIDE OF THE DOOR.

END OF SECTION

Door/Hardware Index

BUILDING A

Door #	HWSet #
A100A	07
A100B	01
A100C	03
A101A	02
A102A	09
A103A	06
A105A	10
A106A	10
A107A	04
A108A	10
A109A	05
A111A	04
A111B	12
A112A	14
A112B	15
A112C	12
A113A	15
A114A	13

BUILDING B

Door #	HWSet #
B100	08
B100B	11
B100C	11

BUILDING C

Door #	HWSet #
C100A	08
C100B	11
C101A	16
C102A	16
C103A	13

SECTION 08800 - GLASS AND GLAZING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

- A. The extent of glass and glazing work is shown on the drawings.
- B. The required applications of glass and glazing include (but are not necessarily limited to) the following:
 - 1. Glazing interior openings.
 - 2. Glazing interior doors.
 - 3. Glazing wood doors and windows.
 - 4. Glazing FRP flush doors.

1.03 QUALITY ASSURANCE:

- A. Prime Glass Standard: Comply with FS DD-G-451.
- B. Heat-Treated Glass Standard: Comply with the following as applicable.
 - 1. Consumer Product Safety Commission 16 CFR 1201.
 - 2. Industry Standards ANSI 297.1.
- C. Insulating Glass Seal Standard: Comply with proposed standard ASTM E6-P-3, Test Methods P1 and P2.
- D. Manufacturers: Provide each type of glass and primary sealant/gasket from a single manufacturer with not less than 5 years of successful experience in the production of materials similar to those required.
- E. Installer (Glazier): Firm with not less than five (5) years of successful experience in glazing work similar to

required work.

1.04 SUBMITTALS:

A. Product Data:

1. Submit manufacturer's product specifications, including documentation to compliance with requirements and instructions for handling, storing, installing, cleaning and protecting each type of glass and glazing materials.

B. Samples:

1. Submit two (2) samples of each type of glass and glazing material required, except for single-pane clear glass (including annealed and tempered). Submit 12" square glass samples and 12" lengths of installed (mocked-up) glazing materials.
 - a. Submit insulating glass samples with completed edge-seal construction, but hermetic seal need not be maintained.

C. Warranties:

1. Warranty on Insulating Glass Units: Provide written warranty signed by fabricator (manufacturer) and countersigned by Contractor agreeing to within 10 years from date of substantial completion replace glass units with defective hermetic seal of air spaces (but not including that due to glass breakage); defined to include intrusion of dirt or moisture, internal condensation or fogging at temperature above -20 degrees F., deterioration of protected internal glass coatings resulting from seal failure, and other visual evidence of seal failure or performance; provide the manufacturer's printed and submitted instructions for handling, protecting, and maintaining units that have been adhered to during the warranty period.
2. Warranty on Laminated Glass: Provide written warranty signed by laminator (manufacturer) and countersigned by Contractor agreeing to within five (5) years after date of acceptance, replace glass units with defective lamination, defined to include evidence of delamination, changes in required strengths, transmittances, color, transparency, and other

required performance.

1.05 PRODUCT HANDLING:

- A. Comply with manufacturer's instructions for shipping, handling, storing, and protecting glass and glazing materials. Exercise exceptional care to prevent edge damage to glass, and damage/deterioration to coatings on glass.

1.06 JOB CONDITIONS:

- A. Pre-Installation Meeting: Comply with General Requirements for pre-installation meeting of Glazier and other trades affected by glass installation.
- B. Weather: Do not proceed with glazing under adverse weather conditions. Install liquid sealants when temperatures are within lower or middle third of temperature range recommended by manufacturer.

PART 2 - PRODUCTS

2.01 GLASS

A. Processed Glass:

- 1. Tempered Glass: Heat treat to strengthen glass in bending to not less than 4.5 times annealed strength.
- 2. Tong Marks: Wherever the glazing system shown for the installation of tempered glass will not conceal the tong marks inherent from normal tempering processes, provide tempered glass produced by special process which eliminates tong marks.

B. Fabricated Products:

1. Laminated Glass:

- a. Laminate units at the factory using manufacturer's standard pressure-plus-heat process to produce units of the required sizes, thicknesses, and component make-up to comply with the details and performance requirements shown and specified herein. Exercise extreme precautions and plant control in the laminating process to exclude dirt and other foreign matter from the lamination, and to eliminate voids and achieve complete lamination at each glass surface.

- b. Fabricate units to proper size and shape at the factory so that no cutting, seaming, or nipping will be required for installation at the project site.
- c. Provide the following type:
 - (1) 1/4" Clear of Solexia (transparent) by PPG or equal consisting of:
 - Exterior Glass: 1/8" tempered
 - Laminating Film: 30 mils thick
 - Interior Glass: 1/8" tempered glass
 - A. ``Solexia Glass``
 - Visible light transmission 69%
 - U value winter 0.47
 - U value summer 0.50
 - SHGC 0.49
 - Shading Coefficient 0.57
 - Outdoor visible light reflectance 13%
 - Outdoor appearance: Light green color, low reflective glass product
- C. Design Thickness:
 - 1. Verify all glass thicknesses will comply with performance requirements.
- D. Manufacturer of Glass: One of the following:
 - 1. Old Castle Building Envelope
 - 2. Saint-Gobain North America
 - 3. Pilkington North America, Inc.
 - 4. PPG Industries, Inc.
 - 5. Guardian Industries, North America
 - 6. Viracon, Inc., Owatonna, MN
- E. Edges:
 - 1. Polish edges wherever exposed to view.
- G. Foatings:
 - 1. Provide low emissivity (low-E) pyrolytic coating (on

#3 surface of insulated units unless noted otherwise).

2.02 GLAZING SEALANTS, COMPOUNDS AND GASKETS:

- A. Colors: Provide black or other natural color where no other color is available. Where material is not exposed to view, provide manufacturer's standard color which has the best overall performance characteristics for application shown.
- B. Hardnesses shown and specified are intended to indicate general range necessary for overall performance. Consult manufacturer's technical representative to determine actual hardness recommended for conditions of installation and use. Owner's representative will furnish information concerning anticipated glass movement related to actual glazing channel width and installation temperature upon request. Except as otherwise indicated or recommended, provide glazing materials within the following ranges of hardness (Shore A, fully cured, at 75 degrees F.):
 - 1. 15 to 35 for elastomeric compounds and tapes used with rigid stops and frames for large glass sizes (in excess of 100 united inches). Provide material sufficiently hard to withstand exposure (if any) to abrasion and vandalism.
 - 2. 25 to 50 for rubber-like curing compounds used with rigid stops and frames for medium and small glass sizes (less than 100 united inches). Provide materials sufficiently hard to withstand impact where used on moving sash and doors.
 - 3. 35 to 60 for molded gaskets used with rigid stops and frames, depending upon strength needed for applications or insertion of units and open profile of gasket.
 - 4. 70 to 80 for structural gaskets (not supported by stops).
 - 5. Non-Elastomeric Compounds: (Shore A not applicable) 2 to 12 mm penetration for 5.0 seconds of penetrometer needle on nominally cured compound (ASTM D 2451).
- C. Compatibility: Before purchase of specified glazing materials, investigate compatibility with channel surfaces, joint fillers, and other materials in glazing channel. Provide only materials (manufacturer's

recommended variation of specified materials) which are known to be fully compatible with actual installation condition, as shown by manufacturer's published data or certification.

- D. Provide size and shape of gaskets and preformed glazing units as shown, or if not shown, as recommended by manufacturer, either in published data or upon consultation with technical representative.
- E. Nonporous Bond Silicone Rubber Glazing Sealant"
 - 1. One-part acid-type silicone rubber elastomeric sealant, complying with FS TT-S-001543, Class A, non-sag, recommended by manufacturer for non-porous exterior joint surfaces and for glazing.
 - 2. Products/Manufacturers: Provide one of the following:
 - a. 781 Building Sealant; Dow Corning Corporation
 - b. Silicone Construction 1200 Sealant; General Electric Company
 - c. Rhodorsil Sealant 3B; Rhodia Inc. Chemical Division
- F. Preformed Butyl Rubber Glazing Sealant:
 - 1. Preformed ribbon or tape (coiled with release paper) of polymerized butyl (or mixture of butyl and polyisobutylene) with inert fillers (pigments), solvent-based with minimum 95% solids, non-sag consistency, tack-free time of 24 hours or less, paintable, non-staining, pre-shimming to prevent stretch (as required by Glazier to facilitate proper application and glass installation).
 - 2. Product/Manufacturer:
 - a. Polyshim Tape: Tremco, Inc.
 - 3. Use for exterior glazing of all glass in aluminum framing and in all interior glazing.

2.03 MISCELLANEOUS GLAZING MATERIALS:

- A. Channel Cleaner: Use type compound recommended by sealant manufacturer for channel surfaces to be cleaned.
- B. Channel Primer/Sealer: Provide type of primer or sealer recommended by sealant manufacturer for application of sealant to channel surfaces.

- C. Setting Blocks: Neoprene or other resilient blocks of 70 to 90 Shore A durometer hardness, tested for compatibility with specified glazing sealants.
- D. Spacers: Neoprene or other resilient blocks of 40 to 50 Shore A durometer hardness, adhesively backed on one face only, tested for compatibility with specified glazing sealants.
- E. Compressible Filler Rod: Closed-cell or waterproof-jacketed foam of polyethylene, butyl rubber, neoprene, polyurethane, or vinyl tested for compatibility with specified glazing sealants of 5 to 10 psi compression strength(25% deflection) as recommended by sealant manufacturers for use in glazing channel to prevent sealant exudation from channel.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Glazier must examine framing and substrate work to receive glass and glazing materials and conditions under which glass is to be installed, and notify General Contractor, in writing, of conditions detrimental to proper completion of the work. Do not proceed with glazing until unsatisfactory conditions have been corrected in a manner acceptable to Glazier.

3.02 PERFORMANCE REQUIREMENTS:

- A. Watertight and airtight installation of each piece of glass is required, except as otherwise shown. Each installation must withstand normal temperature changes wind loading, and impact loading (for operating sash and doors) without failure, including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials and other defects in the work.
- B. Protect glass from edge damage during handling, installation and operation of building systems/equipment. Glass breakage during warranty period is a form of faulty material or workmanship (resulting from edge damage) unless known to result from vandalism or other causes not related to materials and workmanship.
- C. Glazing channel dimensions as shown are intended to provide for necessary minimum bite on glass, minimum edge clearance, and adequate sealant thickness with reasonable

tolerances. Glazier is responsible for correct glass size for each opening within tolerances and necessary dimensions established.

3.03 INSTALLATION

A. General and Standards:

1. Comply with combined recommendations of glass manufacturer and manufacturer of sealants and other materials used in glazing, except where more stringent requirements are shown or specified, and except where manufacturers' technical representatives direct otherwise.
2. Unify appearance of each series of lights by setting each piece to match others as nearly as possible. Inspect each piece and set with pattern, drawn, and bow oriented in the same direction as other pieces.
3. Inspect each piece of glass immediately before installation and eliminate pieces which have observable edge damage or face imperfections.
4. Do not attempt to cut, seam, nip or abrade glass which is tempered, heat strengthened, or coated.
5. Cut and install colored (tinted) and heat absorbing glass as recommended in "Technical Services Report No. 104" (latest edition) by PPG Industries, or similar report by other glass manufacturer.
6. Comply with applicable publications by Flat Glass Marketing Association, except as shown and specified otherwise, and except as specifically recommended otherwise by the manufacturers of the glass and glazing materials.

B. Preparation of Substrate:

1. Clean the glazing channel or other framing member to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to the substrate. Remove lacquer from metal surfaces where elastomeric sealants are used.
2. Apply primer or sealer to joint surfaces where recommended by sealant manufacturer.

C. Sealant/Compound Glazing:

1. Install setting blocks of proper size in sill rabbet, locate at one-fourth of glass width measured from each jamb. Set blocks in thin course of the heel bead compound if heel bead is to be installed.
2. Provide spacers inside and out, and of proper size and spacing for glass sizes larger than 50 united inches, except where pre-shimmed tape or gaskets are used for glazing. Provide 1/8" minimum bite of spacers on glass and use thickness equal to sealant width, except with butyl rubber sealant tape use thickness 1/32" less than final compressed thickness of tape.
3. Voids and Filler Rods: Prevent exudation of sealant or compound by forming voids or installing filler rods in channels at heel of jambs and heads (do not leave voids in sill channels), except as otherwise indicated. In general, voids or filler rods are required for insulating glass and for laminated glass larger than 75 united inches, and for other glass more than 9/32" thick or larger than 120 united inches.
4. Force sealants into channel to eliminate air pockets and voids (other than expansion voids), and to ensure complete "wetting" and bond of sealant to glass and channel surfaces.
5. Tool exposed surfaces of glazing sealants and compounds to provide a substantial "wash" away from glass.
6. When installing processed glass, exercise extraordinary care to avoid contact of glazing materials with processed surfaces, except where concealed in glazing channel. Use masking tape to ensure limitation of compounds to channel area.
7. Clean and trim excess glazing materials from glass and stops or frames promptly after installation, and eliminate stains and discolorations.

D. Gaskets and Tapes:

1. Miter cut and bond ends together at corners where gaskets are used for channel glazing so that gaskets will not pull away from corners and result in voids or leaks in glazing system.
2. Install pressurized tapes and gaskets to protrude slightly out of channel so as to eliminate dirt and moisture pockets. Trim to straight line as required.

3.04 CURE AND PROTECTION:

- A. Cure glazing sealants and compounds in compliance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength, and surface durability.
- B. Glazier shall advise the General Contractor of procedures required for protection of glass and glazing sealants and compounds during construction period so that they will be without deterioration or damage (other than normal weathering) at time of Owner's acceptance.
 - 1. Furnish specific instruction to the General Contractor on precautions and provisions required to prevent glass damage resulting from the alkaline wash from green concrete surfaces and similar sources of possible damage.
 - 2. Protect exterior glass from breakage immediately upon installation by attachment of crossed streamers to framing held away from glass. Do not apply markers directly on surfaces of glass. Except as otherwise indicated, remove applied labels from glass surfaces immediately after glass installation.
 - 3. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during the construction period, including pieces damaged through natural causes, accidents and vandalism.

3.05 CLEANING GLASS:

- A. Maintain glass in a reasonably clean condition during construction so that it will not be damaged by corrosive or erosive action and will not contribute (by wash-off) to deterioration of glazing materials and other work.
 - 1. Clean glass in accordance with manufacturer's recommendations. Do not use abrasive materials. On glass, do not use broken razor blades for cleaning.
- B. Wash and polish glass on both faces not more than 4 days prior to Owner's acceptance of the work in each area. Comply with glass manufacturer's recommendations.

END OF SECTION 08800

SECTION 09250 - GYPSUM DRYWALL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUMMARY:

- A. Extent of each type of gypsum drywall construction required is indicated on Drawings.
- B. This Section includes the following types of gypsum board construction:
 - 1. Steel framing members to receive gypsum board.
 - 2. Gypsum board screw-attached to steel framing and furring members.

1.3 DEFINITIONS:

- A. Gypsum Board Construction Terminology: Refer to ASTM C 11 and GA 505 for definitions of terms for gypsum board construction not otherwise defined in this section or other referenced standards.

1.4 SUBMITTALS:

- A. Product data from manufacturers for each type of product specified.

1.5 QUALITY ASSURANCE:

- A. Fire-Resistance Ratings: Where indicated, provide materials and construction which are identical to those of assemblies whose fire resistance rating has been determined per ASTM E 119 by a testing and inspecting organization acceptable to authorities having jurisdiction.
 - 1. Provide fire-resistance-rated assemblies identical to those indicated by reference to GA File No's. in GA-600 "Fire Resistance Design Manual" or to design designations in U.L. "Fire Resistance Directory" or in listing of other testing and agencies acceptable to authorities having jurisdiction.

- B. Single Source Responsibility: Obtain each type of gypsum board and related joint treatment materials from a single manufacturer.
- C. All gypsum board drywall and associated materials shall be manufactured domestically in the United States, by a United States Company and shall conform to ASTM Standards listed herein. Gypsum board drywall and associated materials shall not be imported, rebranded or distributed from another country.

1.6 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.
- C. Handle gypsum boards to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads and trim.

1.7 PROJECT CONDITIONS:

- A. Environmental Conditions, General: Establish and maintain environmental conditions for application and finishing gypsum board to comply with ASTM C 840 and with gypsum board manufacturer's recommendations.
- B. Minimum Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40 deg F (4 deg C). For adhesive attachment and finishing of gypsum board maintain not less than 50 deg F (10 deg C) for 48 hours prior to application and continuously thereafter until drying is complete.
- C. Ventilate building spaces to remove water not required for drying joint treatment materials. Avoid drafts during dry, hot weather to prevent materials from drying too rapidly.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
 - 1. Steel Framing and Furring:
 - a. Clark Dietrich Framing.
 - b. Jaimes Industries, Inc.
 - c. Marino/Ware, Division of Ware Industries
 - 2. Gypsum Boards and Related Products:
 - a. Gold Bond Building Products Div., National Gypsum Co.
 - b. Georgia Pacific
 - c. Certainteed

2.2 STEEL FRAMING COMPONENTS FOR SUSPENDED AND FURRED CEILINGS:

- A. General: Provide components which comply with ASTM C 754 for materials and sizes, unless otherwise indicated.
- B. Concrete Inserts: Inserts designed for attachment to concrete forms and for embedment in concrete, fabricated from corrosion-resistant materials, with holes or loops for attachment of hanger wires and capability to sustain, without failure, a load equal to 3 times that imposed by ceiling construction, as determined from testing per ASTM E 488, conducted by an independent testing laboratory.
- C. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.
- D. Channels: Cold-rolled steel, 0.0598 inch minimum thickness of base (uncoated) metal and 7/16 inch wide flanges, protected with rust-inhibitive paint, and as follows:
 - 1. Carrying Channels: 1-1/2 inch deep, 475 lbs per 1000 ft., unless otherwise indicated.
 - 2. Furring Channels: 3/4 inch deep, 300 lbs per 1000 ft., unless otherwise indicated.
- E. Steel Studs for Furring Channels: ASTM C 645, with flange edges bent back 90 deg and doubled over to form 3/16 inch minimum lip (return), minimum thickness of base (uncoated) metal and minimum depth as follows:

1. Thickness: 0.0329 inch, unless otherwise indicated.
 2. Depth: 3-5/8 inches, unless otherwise indicated.
- F. Steel Rigid Furring Channels: ASTM C 645, hat-shaped, depth of 1-1/2 inches, and minimum thickness of base (uncoated) metal as follows:
1. Thickness: 0.0329 inch, unless otherwise indicated.
- G. Steel Resilient Furring Channels: Manufacturer's standard product designed to reduce sound transmission, complying with ASTM C 645 for material, finish and widths of face and fastening flange, fabricated to form 1/2 inch deep channel of the following configuration:
1. Single-Leg Configuration: Assymetric-shaped channel with face connected to a single flange by a single slotted leg (web).
- H. Grid Suspension System: ASTM C 645, manufacturer's standard grid suspension system composed of main beams and cross furring members which interlock to form a modular supporting network.

2.3 STEEL FRAMING FOR WALLS AND PARTITIONS:

- A. Steel Studs and Runners: ASTM C 645, with flange edges of studs bent back 90 deg and doubled over to form 3/16" minimum lip (return) and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth:
1. Thickness: 0.0329 inch where indicated.
 2. Depth: 3-5/8 inches, unless otherwise indicated.
- B. Steel Rigid Furring Channels: ASTM C 645, hat-shaped, depth and minimum thickness of base (uncoated) metal as follows:
1. Depth: 1-1/2 inches. (7/8" where noted)
 2. Thickness: 0.0329 inch, unless otherwise indicated.
- C. Furring Brackets: Serrated-arm type, adjustable, fabricated from corrosion-resistant steel sheet complying with ASTM C 645, minimum thickness of base (uncoated) metal of 0.0329 inch, designed for screw attachment to steel studs and steel rigid furring channels used for furring.

- D. Steel Resilient Furring Channels: Manufacturer's standard product designed to reduce sound transmission, complying with ASTM C 645 for base metal, finish and widths of face and fastening flange, fabricated to form 1/2 inch deep channel of the following configuration:
1. Single-Leg Configuration: Assymetric-shaped channel with face connected to a single flange by a single slotted leg (web).
- E. Fasteners: Provide fasteners of type, material, size, corrosion resistance, holding power and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum drywall manufacturers for applications indicated.

2.4 GYPSUM BOARD:

- A. General: Provide gypsum board of types indicated in maximum lengths available to minimize end-to-end joints.
1. Thickness: Provide gypsum board in thicknesses indicated, or if not otherwise indicated, in either 1/2 inch or 5/8 inch thicknesses to comply with ASTM C 840 for application system and support spacing indicated.
- B. Gypsum Wallboard: ASTM C1396, and as follows:
1. Type: Regular, unless otherwise indicated.
 2. Type: Foil-backed where indicated.
 3. Type: Type X for fire-resistance-rated assemblies.
 4. Edges: Tapered.
 5. Thickness: 5/8 inch.
 6. Products: Subject to compliance with requirements, provide one of the following products where Type X gypsum wallboard is indicated:
 - a. "Fire-Shield G"; Gold Bond Building Products Div., National Gypsum Co.
 - b. "SHEETROCK Brand FIRECODE 'C' Gypsum Panels"; United States Gypsum Co.
 - c. Type X gypsum board - Certainteed
 - d. Tough Rock Fireguard X gypsum board - Georgia Pacific

- C. Gypsum Backing Board for Multi-Layer Applications: ASTM C1396 or, where backing board is not available from manufacturer, gypsum wallboard, ASTM C1396, and as follows:
1. Type: Regular, unless otherwise indicated.
 2. Type: Foil-backed where indicated.
 3. Type: Type X for fire-resistance-rated assemblies.
 4. Edges: Manufacturer's standard.
 5. Thickness: 5/8 inch.
- D. Water-Resistant Gypsum Backing Board: ASTM C1396, and as follows:
1. Type: Regular, unless otherwise indicated.
 2. Type: Type X for fire-resistance-rated assemblies.
 3. Thickness: 5/8 inch, unless otherwise indicated.
- E. Abuse Resistant Gypsum Wallboard (VHI - Very High Impact) ASTM C1278 and C1629 manufactured to produce greater resistance to surface indentation and through penetration than standard gypsum panels, 5/8'' thick with tapered edges.
1. Products:
 - a. Gold Bond Hi-Impact brand XP wallboard; National Gypsum Company. (with profoam joint tape and profoam ready mix or setting compound)
 - b. Fiberock VHI brand abuse-resistant gypsum panels; United States Gypsum Co.
 - c. Air renew extreme impact - Certainteed
- F. Acoustically Enhanced Gypsum Board:
1. Thickness: 5/8'' Type X
 - a. Inner layer: viscoelastic damper polymer
 - b. Outer layer: enhanced high density mold resistant gypsum board.
 2. Long edges: tapered.
 3. Mold Resistance:
 - a. ASTM D3273, Score of 10
 - b. ASTM G21, score of 0
 4. Environmental Requirements: Provide products that comply with testing and product requirements for low emitting materials.

5. STC rated assemblies: For STC rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by independent testing agency.
6. Manufacturers:
 - a. Gold Bond-Sound Break XP gypsum board - National Gypsum Company
 - b. Silent FX gypsum board - Certainteed
 - c. Tough Rock Sound Deadening Board - Georgia Pacific
7. Install per manufacturers specifications with acoustical sealant meeting ASTM C919 and firestopping meeting ASTM E90. Install acoustic sealant at perimeter of boards and around all penetrations. Install putty pads at all receptacles and switch locations. Install fireproofing and fire sealant around all fire rated partitions.

2.5 TRIM ACCESSORIES:

- A. Cornerbead and Edge Trim for Interior Installation:
Provide corner beads, edge trim and control joints which comply with ASTM C 1047 and requirements indicated below:
 1. Material: Formed metal, plastic or metal combined with paper, with metal complying with the following requirement:
 - a. Sheet steel zinc-coated by hot-dip process.
 2. Edge trim shapes indicated below by reference to designations of Fig. 1 in ASTM C 1047:
 - a. "LC" Bead, unless otherwise indicated.
 - b. "L" Bead where indicated.
 - c. "U" Bead where indicated.
 3. One-Piece Control Joint: Formed with vee-shaped slot per Fig. 1 in ASTM C 1047, with slot opening covered with removable strip.
- B. Metal Cornerbead and Edge Trim for Exterior Ceilings:
Comply with the following requirements:
 1. Edge trim complying with ASTM C 1047, formed from rolled zinc, shape "LC" Bead per Fig. 1, unless otherwise indicated.
- C. All exterior gypsum corners, including abuse resistant gypsum board (VH1), shall have a cover guard with anchor plate and snap on cover.

2.6 GYPSUM BOARD JOINT TREATMENT MATERIALS:

- A. General: Provide materials complying with ASTM C 475, ASTM C 840, and recommendations of manufacturer of both gypsum board and joint treatment materials for the application indicated.
- B. Joint Tape: Paper reinforcing tape, unless otherwise indicated.
 - 1. Use pressure sensitive or staple-attached open-weave glass fiber reinforcing tape with compatible joint compound where recommended by manufacturer of gypsum board and joint treatment materials for application indicated.
- C. Setting-Type Joint Compounds: Factory-prepackaged, job-mixed, chemical-hardening powder products formulated for uses indicated.
 - 1. Where setting-type joint compounds are indicated for use as taping and topping compounds, use formulation for each which develops greatest bond strength and crack resistance and is compatible with other joint compounds applied over it.
 - 2. For prefilling gypsum board joints, use formulation recommended by gypsum board manufacturer for this purpose.
 - 3. For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by gypsum board manufacturer for this purpose.
- D. Drying-Type Joint Compounds: Factory-prepackaged vinyl-based products complying with the following requirements for formulation and intended use.
 - 1. Ready-Mix Formulation: Factory-premixed product.
 - 2. All-purpose compound formulated for use as both taping and topping compound.

2.7 MISCELLANEOUS MATERIALS:

- A. General: Provide auxiliary materials for gypsum drywall construction which comply with referenced standards and the recommendations of the manufacturer of the gypsum board.

- B. Laminating Adhesive: Special adhesive or joint compound recommended for laminating gypsum boards.
- C. Spot Grout: ASTM C 475, setting-type joint compound of type recommended for spot grouting hollow metal door frames.
- D. Fastening Adhesive for Wood: ASTM C 557.
- E. Fastening Adhesive for Metal: Special adhesive recommended for laminating gypsum boards to steel framing.
- F. Gypsum Board Screws: ASTM C 1002.
- G. Gypsum Board Nails: ASTM C 514.
- H. Concealed Acoustical Sealant: Nondrying, nonhardening, nonskinning, nonstaining, nonbleeding, gunnable sealant complying with requirement specified in Division-7 section "Joint Sealers."
- I. Sound Attenuation Blankets: Unfaced mineral fiber blanket insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with FS HH-1-521 for Type I with class 25 flame spread and as follows:
 - 1. Mineral Fiber Type: Fibers manufactured from glass.
 - 2. Use in all partitions.
 - 3. Equal to USG thermafiber sound attenuation fire blankets (SAFB).

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Examine substrates to which drywall construction attaches or abuts, preset hollow metal frames, cast-in-anchors, and structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of drywall construction. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION:

- A. Ceiling Anchorages: Coordinate installation of ceiling suspension system with installation of overhead structural systems to ensure that inserts and other structural anchorage provisions have been installed to receive ceiling anchors in a manner that will develop their full strength and at spacing required to support ceiling.

3.3 INSTALLATION OF STEEL FRAMING, GENERAL:

- A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.
- B. Install supplementary framing, blocking and bracing at terminations in the work and for support of fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, and similar construction to comply with details indicated and with recommendations of gypsum board manufacturer, or if none available, with "Gypsum Construction Handbook" published by United States Gypsum Co.
- C. Isolate steel framing from building structure to prevent transfer of loading imposed by structural movement, at locations indicated below to comply with details shown on Drawings:
 - 1. Where edges of suspended ceilings abut building structure horizontally at ceiling perimeters or penetration of structural elements.
 - 2. Where partition and wall framing abuts overhead structure.
 - a. Provide slip or cushioned type joints as detailed to attain lateral support and avoid axial loading.
- D. Do not bridge building expansion and control joints with steel framing or furring members; independently frame both sides of joints with framing or furring members or as indicated.

3.4 INSTALLATION OF STEEL FRAMING FOR SUSPENDED AND FURRED CEILINGS:

- A. Secure hangers to structural support by connecting directly to structure where possible, otherwise connect to cast-in concrete inserts or other anchorage devices or fasteners as indicated.

1. Do not attach hangers to metal deck tabs.
 2. Do not attach hangers to metal roof deck.
- B. Do not connect or suspend steel framing from ducts, pipes or conduit.
- C. Keep hangers and braces 2 inches clear of ducts, pipes and conduits.
- D. Sway-brace suspended steel framing with hangers used for support.
- E. Install suspended steel framing components in sizes and at spacings indicated but not less than that required by referenced steel framing installation standard.
1. Wire Hangers: 0.1620 inch diameter (8 gage), 4 ft. on center.
 2. Carrying Channels (Main Runners): 1-1/2 inch, 4 ft. on center.
 3. Rigid Furring Channels (Furring Members): 16 inches on center.
 4. Rigid Furring Channels (Furring Members): 24 inches on center.
- F. Installation Tolerances: Install steel framing components for suspended ceilings so that cross furring members or grid suspension members are level to within 1/8 inch in 12 ft. as measured both lengthwise on each member and transversely between parallel members.
- G. Wire-tie or clip furring members to main runners and to other structural supports as indicated.

3.5 INSTALLATION OF STEEL FRAMING FOR WALLS AND PARTITIONS:

- A. Install runners (tracks) at floors, ceilings and structural walls and columns where gypsum drywall stud system abuts other construction.
1. Where studs are installed directly against exterior walls, install asphalt felt strips between studs and wall.
- B. Installation Tolerances: Install each steel framing and furring member so that fastening surface do not vary more than 1/8 inch from plane of faces of adjacent framing.

- C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
- D. Terminate partition framing at suspended ceilings only where specifically indicated.
- E. Install steel studs and furring in sizes and at spacings indicated but not less than that required by referenced steel framing installation standard.
 - 1. For single layer construction: 16 inches on center.
- F. Install steel studs so that flanges point in the same direction and gypsum boards can be installed in the direction opposite to that of the flange.
- G. Frame door openings to comply with details indicated, with GA-219 and with applicable published recommendations of gypsum board manufacturer. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - 1. Extend vertical jamb studs through suspended ceilings and attach to underside of floor or roof structure above.
- H. Frame openings other than door openings to comply with details indicated, or if none indicated, in same manner as required for door openings; and install framing below sills of openings to match framing required above door heads.

3.6APPLICATION AND FINISHING OF GYPSUM BOARD, GENERAL:

- A. Install abuse resistant gypsum board (VH1) typical where indicated on drawings.
- B. Gypsum Board Application and Finishing Standard: Install and finish gypsum board to comply with ASTM C 840.
- C. Install sound attenuation blankets prior to gypsum board unless readily installed after board has been installed.
- D. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 24

- inches in alternate courses of board.
- E. Install ceiling boards across framing in the manner which minimizes the number of end-butt joints, and which avoids end joints in the central area of each ceiling. Stagger end joints at least 24 inches.
 - F. Install wall/partition boards in manner which minimizes the number of end-butt joints or avoids them entirely where possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs.
 - G. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16 inch open space between boards. Do not force into place.
 - H. Locate either edge or end joints over supports, except in horizontal applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field-cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.
 - I. Attach gypsum board to steel studs so that leading edge or end of each board is attached to open (unsupported) edge of stud flange first.
 - J. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.
 - K. Spot grout hollow metal door frames for solid core wood doors, hollow metal doors and doors over 32 inches wide. Apply spot grout at each jamb anchor clip just before inserting board into frame.
 - L. Form control joints and expansion joints at locations indicated, with space between edges of boards, prepared to receive trim accessories.
 - M. Cover both faces of steel stud partition framing with gypsum board in concealed spaces (above ceilings, etc.), except in chase walls which are braced internally.
 - 1. Except where concealed application is indicated or required for sound, fire, air or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. area, and may be limited to not less

- than 75 percent of full coverage.
2. Fit gypsum board around ducts, pipes, and conduits.
- N. Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide 1/4 inch to 1/2 inch space and trim edge with "U" bead edge trim. Seal joints with acoustical sealant.
- O. At all drywall partitions, seal construction at perimeters, control and expansion joints, openings and penetrations with a continuous bead of acoustical sealant including a bead at both faces of partitions. Comply with ASTM C 919 and manufacturer's recommendations for location of edge trim, and close off sound-flanking paths around or through construction, including sealing of partitions above acoustical ceilings.
- P. Space fasteners in gypsum boards in accordance with referenced gypsum board application and finishing standard and manufacturer's recommendations.

3.7 METHODS OF GYPSUM BOARD APPLICATION:

- A. Single-Layer Application: Install gypsum wallboard as follows:
1. On ceilings apply gypsum board prior to wall/partition board application to the greatest extent possible.
 2. On partitions/walls apply gypsum board vertically (parallel to framing), unless otherwise indicated, and provide sheet lengths which will minimize end joints.
 3. On partitions/walls 8'-1" or less in height apply gypsum board horizontally (perpendicular to framing); use maximum length sheets possible to minimize end joints.
- B. Double-Layer Application: Install gypsum backing board for base layer and gypsum wallboard for face layer.
1. On ceilings apply base layer prior to application of base layer on walls/partitions; apply face layers in same sequence. Offset joints between layers at least 10 inches. Apply base layers at right angles to supports unless otherwise indicated.
 2. On partitions/walls apply base layer and face layers vertically (parallel to framing) with joints of base layer over supports and face layer joints offset at least 10 inches with base layer joints.

- C. Acoustical Tile Base: Where drywall is base for adhesively applied acoustical tile, install gypsum backing board.
 - 1. Provide either V-joint type backing board or tape and finish joints to produce a flat surface.
- D. Single-Layer Fastening Methods: Apply gypsum boards to supports as follows:
 - 1. Fasten with screws.
- E. Double-Layer Fastening Methods: Apply base layer of gypsum board and face layer to base layer as follows:
 - 1. Fasten both base layers and face layers separately to supports with screws.
- F. Direct-Bonding to Substrate: Where gypsum board is indicated to be directly adhered to a substrate (other than studs, joists, furring members or base layer of gypsum board), comply with gypsum board manufacturer's recommendations, and temporarily brace or fasten gypsum board until fastening adhesive has set.

3.8 INSTALLATION OF DRYWALL TRIM ACCESSORIES:

- A. General: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges to comply with manufacturer's recommendations.
- B. Install corner beads at external corners.
- C. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed, and except where plastic trim is indicated. Provide type with face flange to receive joint compound except where "U" bead (semi-finishing type) is indicated.
 - 1. Install "LC" bead where drywall construction is tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
 - 2. Install "L" bead where edge trim can only be installed after gypsum board is installed.
 - 3. Install U-type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints).

- D. Install plastic edge trim where indicated on wall panels at juncture with ceilings.
- E. Install control joints at locations indicated, or if not indicated, at spacings and locations required by referenced gypsum board application and finish standard, and approved by the Architect for visual effect.

3.9 FINISHING OF DRYWALL:

- A. General: Apply joint treatment at gypsum board joints (both directions); flanges of corner bead, edge trim, and control joints; penetrations; fastener heads, surface defects and elsewhere as required to prepare work for decoration.
- B. Prefill open joints and rounded or beveled edges, if any, using setting-type joint compound.
- C. Apply joint tape at joints between gypsum boards, except where trim accessories are indicated.
- D. Finish interior gypsum wallboard by applying the following joint compounds in 3 coats (not including prefill of openings in base), and sand between coats and after last coat:
 - 1. Embedding and First Coat: Setting-Type Joint Compound.
 - 2. Fill (Second) Coat: Setting-type joint compound.
 - 3. Finish (Third) Coat: Ready-mix drying-type all-purpose or topping compound.
 - 4. Provide a Level 5 gypsum board finish at all Abuse Resistant (VHI) gypsum board locations, unless noted otherwise.
- E. Base for Acoustical Tile: Where gypsum board is indicated as a base for adhesively-applied acoustical tile, install tape and 2-coat compound treatment, without sanding.
- F. Partial Finishing: Omit third coat and sanding on concealed drywall construction which is indicated for drywall finishing or which requires finishing to achieve fire-resistance rating, sound rating or to act as air or smoke barrier.

3.10 PROTECTION:

- A. Provide final protection and maintain conditions, in a manner suitable to Installer, which ensures gypsum drywall construction being without damage or deterioration at time of Substantial Completion.

END OF SECTION 09250

SECTION 09300 - TILE WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

- A. The extent of tile work is shown on drawings and in schedules.

1.03 QUALITY ASSURANCE:

- A. Qualifications of Installers:

- 1. For installation of ceramic tile, use only thoroughly trained and experienced personnel completely familiar with specified products, manufacturer's recommended methods of installation and requirements established for this work.

- B. Codes and Standards:

- 1. Comply with recommendations of "Handbook for Ceramic Tile Installation" published by Tile Council of America.
- 2. Comply with ANSI and ASTM Standards listed within this Section.

- C. Proprietary Materials: Handle, store, mix and apply proprietary setting and grouting materials in compliance with manufacturer's instructions.

1.04 SUBMITTALS:

- A. Product Data:

- 1. For information only, submit two (2) copies of manufacturer's technical information and install instructions for all materials required, except bulk materials. Include certifications and other data as may be required to show compliance with these specifications. Transmit a copy of each instruction to the Installer.

2. Accompany materials list with two (2) copies of manufacturer's current recommended method of installation for each item. These recommendations, after review by Contractor and Architect/Engineer, shall form basis for acceptance or rejection of installed work.

B. Samples:

1. Submit three (3) samples of each type and color of tile required, not less than 12" square on plywood or hardboard backing and grouted. Submit samples of trim and 6" long sample of marble threshold. Review will be for color, pattern and texture only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

1.05 DELIVERY AND STORAGE:

- A. Deliver packaged materials and store in original containers with seals unbroken and labels in tact until time of use, in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Porcelain Pavers

1. Shall meet requirements of TCA 137.1 and requirements of this Section.
2. Porcelain Floor Tile for Public and private Restrooms shall be:
 - a. 12'' x 12'' Florim USA, Stratos in color ``Avorio'', install in quarter turn.
3. Porcelain Wall Tile for Public and Private Restrooms shall be:
 - a. 12'' x 24'' Florim USA, Stratos in color ``Avorio'', install in stacked bond.
 - b. Provide 6'' wall cove base in color to match wall tile.
 - c. Provide st. st. schluter strip at all terminations along top of wall tile. See elevations for ht of wall tile.
 - d. Multiple colors will be used.

4. Porcelain Wall Tile for Shower in Room A108 shall be:

- a. 12'' x 24'' Florim USA, Stratos in color ``Avorio'', install in stacked bond, full ht. of walls.
 - b. Provide 6'' wall cove base in color to match wall tile.
- C. Marble Thresholds: Marble thresholds shall be 1/2" inch high with chamfered edges of a uniform, fine to medium grained white stone with gray veining and conform to ASTM C503 with a minimum abrasion resistance of ten (10) per ASTM C1353 or ASTM C241 and with a honed finish.

2.02 SETTING MATERIALS

- A. MEDIUM SET MORTAR - for wall and floor tile installation in lobby and toilet rooms:
2. Description: Factory prepared mortar and latex additive; complying with ANSI A118.4 and ISO standards C2TES1P1. Medium bed thickness; 3/8 to 3/4 inch thick floor installation.
 3. Color: Gray
 4. Acceptable Products:
 - i. MAPEI UltraFlex LFT, complies with ANSI A118.4
 - ii. Custom Building Products, MegaLite.
 - iii. Laticrete, 4XLT.
- B. Latex-Portland Cement Mortar: ANSI A118.4, composed as follows :
1. Mixture of Dry-Mortar Mix and Latex Additive: Mixture the prepackaged dry-mortar mix and liquid-latex additive complying with the following requirements:
 - a. Latex Additive: Acrylic resin.
 2. Provide one of the following products:
 - a. Mapei, Elk Grove Village, IL; Kerabond/Keralastic
 - b. Custom Building Products, Custom Blend/Custom Flex
 - c. Laticrete, Bethany, CT; Laticrete 272/333
 - d. TEC, Palatine, IL; Full set plus/Xtra Flex Additive
- C. Waterproofing and Crack Isolation Membrane: Provide materials complying with ANSI A118.10 and ANSI A118.12 and as specified below. Note: All tile (walls & floors) to be installed on crack isolation membrane.:
1. Mapelastick AquaDefense as manufactured by MAPEI Corp.

2. Custom building products RedGard waterproofing and crack prevention membrane.
 3. Hydroment ultra-set advanced as manufactured by Bostik, Inc.
 5. Hydro-Ban waterproofing/anti-fracture membrane as manufactured by Laticrete International, Inc., Bethany, CT.
 6. Hydraflex as manufactured by TEC. Ready to use, flexible, mold and mildew resistant waterproofing and crack isolation membrane for interior and exterior applications.
- D. Crack Isolation Membrane in Lobby area: Provide materials complying with ANSI A118.12 and as specified below:
1. Mapeguard 2, as manufactured by MAPEI Corp.

2.03 GROUTING MATERIALS

- A. Epoxy-modified Grout Admixture: Complying with ANSI A118.8 and A118.3.
1. Provide one of the following manufacturers:
 - a. Mapei, Kerapoxy.
 - b. Custom Building Products, 100 Solids Epoxy Grout
 - c. TEC, 100% Solids Epoxy Mortar & Grout
 - d. Laticrete, Bethany, CT, Spectralock Pro Grout.
- B. Color: As selected by Architect.

2.04 MISCELLANEOUS MATERIAL

- A. Latex Underlayment: Quick set type, as recommended by membrane manufacturer, as required to provide positive drainage to floor drains.
- B. Sealer for Quarry Tile: Shall be a penetrating sealer as manufactured by Aqua Mix Inc., Santa Fe Springs, California, Miracle Sealants Penetrating Sealer, Arcadia, California, or Architect approved equivalent. (Seal prior to grouting)
- C. Sealants for control joints in floors and walls, use one part fungicidal silicone rubber to match grout, Dow Corning 784, meeting Fed. Spec. TT-S-001543, Class A or B.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Installer must examine the areas and conditions under which tile work is to be installed and notify the General Contractor, in writing, of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 PREPARATION:

- A. Prepare substrate to receive setting bed and tile recommended both by the manufacturer of the tile and of the setting bed materials.
 - 1. Fill cracks, holes and depressions with trowelable leveling and patching compound according to tile setting material manufacturer's written instructions.
 - 2. Remove protrusions, bumps and ridges by sanding or grinding.
 - 3. Provide concrete substrates for tile floors that comply with flatness tolerances specified in ANSI A108.
 - 4. Apply skim coat full height to all walls to receive wall tile.
 - 5. Apply self leveling agent to entire floor to receive floor tile.
- B. Clean substrate as required and recommended to achieve bond using cleaners, detergents, etc.
- C. Neutralize and seal substrates as recommended.

3.03 INSTALLATION:

- A. Tile Installation - General:
 - 1. Provide installation of ceramic tile in accordance with Tile Council of America's "Handbook for Ceramic Tile Installation."
 - 2. Fit tile carefully against trim and around pipes, electrical boxes and other built-up fixtures so that escutcheons, plates and collars will completely overlap cut edges.
 - 3. Smooth exposed edges and clean tile before installation.
 - 4. Install ceramic tile with a nominal 1/8" joint (unless

noted otherwise).

5. Joint designs shall be symmetrical within room or area; border tile be not less than 1/2 normal width. Floor tile shall be set in straight line design, with wall joints in alignment with floor tile where possible.
6. At junction of base tile and wall tile, at projections through tile and at junctions of tile to shower receptors, urinals, corner guards and similar equipment, leave joint ungrouted for sealing.
7. When using tile sheets, minimize tearing sheets apart.

3.04 SETTING METHODS

- A. Method and typical detailing for tile work shall be in accordance with the following TCA alphanumeric method, listing from the "Handbook for Ceramic Tile Installation", latest edition, by the Tile Council of America.
- B. Concrete Subfloors
 1. Slabs on Grade at Kitchen areas (Thin-set Method): TCA Setting Method F131-03 (provide with waterproof and crack isolation membrane) Thin Set Mortar and Epoxy Grout complying with Tile Installation Specification ANSI A108.6. Install crack isolation membrane per manufacturer's specs.
 2. Slabs on grade and 2nd concrete floor slabs (thin-set method): TCA setting method F115-03 (provide with waterproof and crack isolation membrane) thin set Portland Cement mortar, epoxy grout complying with tile installation specification ANSI A108.5 and epoxy grout installation specification ANSI A108.6.
- C. Walls
 1. Masonry (Cement Mortar Bond Method): TCA Setting Method W202-03 latex-Portland Cement mortar, install per Tile Installation Specification ANSI A108.5. Install crack isolation membrane per manufacturer's specs.

3.05 GROUTING

- A. Grouting shall be installed in accordance with ANSI A108.10 and the manufacturer's recommended procedures and

precautions during application and cleaning.

- B. Rinse tilework thoroughly with clean water before and after using chemical cleaners.
- C. Base Installation:
 - 1. Over concrete and masonry, install base using dry-set portland cement mortar in accord with ANSI A108.5. Grout using same grout specified for related tile floor.
 - 2. Over gypsum wall board, install base using organic adhesive in accord with ANSI A108. Grout using same grout specified for related tile floor.
- D. Jointing Pattern: Lay tile in pattern indicated. Layout tile work and enter tile fields both directions in such space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint width, unless otherwise shown.
- E. Expansion and Control Joints: Provide as indicated on drawings and as recommended by TCA and by tile and setting bed and grouting material manufacturer and as follows:
 - 1. Control Joints Locations: Comply with the Tile Council of America. (TCA) and where indicated.
 - a. Interior Locations (horizontal and vertical):
 - 1. Over any expansion joint, control joint, cold joint or seismic joint in the building structure.
 - 2. Expansion joints - 24 feet to 36 feet in each direction.
 - 3. Expansion joints - 8 feet to 12 feet where tile work located in direct sunlight or moisture locations.
 - 4. Where tile abuts restraining surfaces such as perimeter walls, dissimilar floors, curbs, columns, pipes, ceiling and where changes occur in backing materials.
 - 5. Coordinate joint locations with the Architect and for other areas indicated or required.
 - 6. Joint width shall be 3/8 inch, unless otherwise indicated.
 - 7. Provide under-layment systems.
 - 8. Install compatible sealant and color approved by the Architect.

b. Exterior Locations (horizontal and vertical)

1. Expansion joints - 8 feet to 12 feet in each direction.
2. Coordinate joint locations with Architect and for other areas indicated or required.
3. Joint width shall be 3/8 inch to 5/8 inch maximum to suit expansion areas.
4. Provide under-layment systems.
5. Install compatible sealant and of color approved by the Architect.

F. Grout all tile using commercial epoxy grout as specified.

1. Temporarily protect tile as required to prevent staining.

3.04 ADJUST AND CLEAN:

A. Cleaning:

1. Clean grout and setting materials from face of tile while materials are workable. Leave tile face clean and free of all foreign matter.
2. Tile may be cleaned with acid solutions only when permitted by the tile and grout manufacturer's printed instructions, but not sooner than 14 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush the surface with clean water before and after cleaning.

B. Finished Tile Work:

1. Leave finished installation clean and free of cracked, chipped, broken, unbonded, or otherwise defective tile work.

C. Protection:

1. Apply a protective coat of neutral protective cleaner to completed tile work.
2. Protect installed tile work with Kraft paper or other heavy covering during the construction period to prevent damage and wear.
3. Prohibit all foot and wheel traffic from using tiled floors for at least 3 days, preferably 7 days.

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DOWNTOWN DEVELOPMENT AUTHORITY
2016 PLACEMAKING PROJECT

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4. Before final inspection, remove protective coverings and rinse neutral cleaner from all tile surfaces.

END OF SECTION 09300

SECTION 09614 - ADA REPLACEABLE CAST IN PLACE DETECTABLE WARNING SURFACES

PART 1. GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division 1 Specifications Section, apply to this Section.

1.02 DESCRIPTION

- A. This Section specifies furnishing and installing Replaceable Cast In Place Detectable/Tactile Warning Surface Tiles where indicated. Not recommended for asphalt applications.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's literature describing products, installation procedures and routine maintenance.
- B. Samples for Verification Purposes: Submit two (2) tile samples minimum 6'' x 6'' of the kind proposed for use.
- C. Shop Drawings are required for products specified showing fabrication details, composite structural system, tile surface profile, fastener and anchor locations, plans of tile placement including joints, and material to be used as well as outlining installation materials and procedure.
- D. Material Test Reports: Submit complete test reports from qualified accredited independent testing laboratories to qualify that materials proposed for use are in compliance with requirements and meet or exceed the properties indicated on the specifications. All tests shall be conducted on a Replaceable Cast In Place Detectable Tactile Warning Surface Tile system as certified by a qualified independent testing laboratory and be current within a 24 month period.
- E. Maintenance Instructions: Submit copies of manufacturer's specified installation and maintenance practices for each type of Detectable Warning Surface Tile and accessory as required.

1.04 QUALITY ASSURANCE

- A. Provide Replaceable Cast In Place Detectable/Tactile Warning Surface Tiles and accessories as produced by a single manufacturer with a minimum of three (3) years experience in the manufacturing of Cast In Place Detectable/Tactile Warning Surface Tiles.
- B. Installer's Qualifications: Engage an experienced installer certified in writing by Replaceable Cast In Place Detectable/Tactile Warning Surface Tile manufacturer as qualified for installation, who has successfully completed installation similar in material, design, and extent to that indicated for Project.
- C. Americans with Disabilities Act (ADA): Provide Replaceable Cast In Place Detectable/Tactile Warning Surface Tiles which comply with the detectable warnings on walking surfaces section of the Americans with Disabilities Act (Title III Regulations, 28 CFR Part 36 ADA STANDARDS FOR ACCESSIBLE DESIGN, Appendix A Section 4.29.2 DETECTABLE WARNINGS ON WALKING SURFACES).
- D. California Code of Regulations (CCR): Provide only approved DSAAC detectable warning products as provided in the California Code of Regulations (CCR) Title 24, Section 1112A.9 and 1127B.5 for "Curb Ramps" and Section 1133B.8.5 for "Detectable Warnings at Hazardous Vehicular Areas".
- E. Vitrified Polymer Composite (VPC) Replaceable Cast In Place Detectable/Tactile Warning Surface Tiles shall be an epoxy polymer composition with an ultra violet stabilization coating employing aluminum oxide particles in the truncated domes. The tile shall incorporate an in-line pattern of truncated domes measuring nominal 0.2" height, 0.9" base diameter, and 0.45" top diameter, spaced center-to-center 3.4" as measured on a diagonal and 2.35" as measured side by side. For wheelchair safety the field area shall consist of a non-slip surface with a minimum of 40 - 90° raised points 0.045" high, per square inch; "Armor-Tile" as manufactured by Engineered Plastics Inc., Tel: 800-682-2525, or approved equal.
 - 1. Dimensions: Replaceable Cast In Place Detectable/Tactile Warning Surface Tiles shall be held within the following dimensions and tolerances:
Length and width: 24" x 48" nominal or as indicated on drawings.

- Depth: .50 (1/2'') (+/-) 5% max.
Face Thickness: 0.1875 (3/16'') (+/-) 5% max.
Warpage of Edge: 0.5% max.
Fasteners/Anchors: 11 min.
2. Water Absorption of Tile when tested by ASTM D 570-98 not to exceed 0.05%.
 3. Slip Resistance of Tile when tested by ASTM C1028-96 the combined Wet and Dry Static Co-Efficient of Friction not to be less than 0.80 on top of domes and field area.
 4. Compressive Strength of Tile when tested by ASTM D 695-02a not to be less than 28,000 PSI.
 5. Tensile Strength of tile when tested by ASTM D 638-03 not to be less than 19,000 PSI.
 6. Flexural Strength of Tile when tested by ASTM D 790-03 not to be less than 25,000 PSI.
 7. Chemical Stain Resistance of Tile when tested by ASTM D 543-95 (re approved 2001) to withstand without discoloration or staining - 10% hydrochloric acid, urine, saturated calcium chloride, black stamp pad ink, chewing gum, red aerosol paint, 10% ammonium hydroxide, 1% soap solution, turpentine, Urea 5%, diesel fuel and motor oil.
 8. Abrasive Wear of Tile when tested by BYK - Gardner Tester ASTM D 2486-00 with reciprocating linear motion of $37 \pm$ cycles per minute over a 10'' travel. The abrasive medium, a 40 grit Norton Metallite sand paper, to be fixed and leveled to a holder. The combined mass of the sled, weight and wood block is to be 3.2 lb. Average wear depth shall not exceed 0.060 after 1000 abrasion cycles when measured on the top surface of the dome representing the average of three measurement locations per sample.
 9. Resistance to Wear of Unglazed Ceramic Tile by Taber Abrasion per ASTM C501-84 (re approved 2002) shall not be less than 500.
 10. Fire Resistance of Tile when tested to ASTM E84-05 flame spread shall be less than 15.
 11. Gardner Impact to Geometry ``GE'' of the standard when tested by ASTM D 5420-04 to have a mean failure energy expressed as a function of specimen thickness of not less than 550 in. lb f/in. A failure is noted when a crack is visible on either surface or when any brittle splitting is observed on the bottom plaque in the specimen.
 12. Accelerated Weathering of Tile when tested by ASTM G 155-05a for 3000 hours shall exhibit the following result- $\Delta E < 4.5$, as well as no

- deterioration, fading or chalking of surface of tile color No. 33538.
13. Accelerated Aging and Freeze Thaw Test of Tile and Adhesive System when tested to ASTM D 1026 shall show no evidence of cracking, delaminating, warpage, checking, blistering, color change, loosening of tiles or other detrimental defects.
 14. Salt and Spray Performance of Tile when tested to ASTM B 117-03 not to show any deterioration or other defects after 200 hours of exposure.
 15. AASHTO HB-17 single wheel HS20-44 loading ``Standard Specifications for Highways and Bridges``. The Replaceable Cast In Place Tile shall be mounted on a concrete platform with 1/32" airspace at the underside of the tile top plate then subjected to the specified maximum load of 10,400 lbs., corresponding to an 8000 lb. individual wheel load and a 30% impact factor. The tile shall exhibit no visible damage at the maximum load of 10,400 lbs.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Replaceable Cast In Place Detectable/Tactile Warning Surface Tiles shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy plastic wrappings to protect tile from concrete residue during installation and tile type shall be identified by part number.
- B. Replaceable Cast In Place Detectable/Tactile Warning Surface Tiles shall be delivered to location at building site for storage prior to installation.

1.06 SITE CONDITIONS

- A. Environmental Conditions and Protection: Maintain minimum temperature of 40°F in spaces to receive Replaceable Cast In Place Detectable/Tactile Warning Surface Tiles for at least 24 hours prior to installation, during installation, and for not less than 24 hours after installation.
- B. The use of water for work, cleaning or dust control, etc. shall be contained and controlled and shall not be allowed to come into contact with the general public. Provide barricades or screens to protect the general public.

1.07 GUARANTEE

- A. Replaceable Cast In Place Detectable/Tactile Warning Surface Tiles shall be guaranteed in writing for a period of five (5) years from date of final completion. The guarantee includes defective work, breakage, deformation, fading and loosening of tiles.

PART 2. PRODUCTS

2.01 MANUFACTURERS

- A. The Vitrified Polymer Composite (VPC) Replaceable Cast In Place Detectable/Tactile Warning Surface Tiles specified is based on Armor-Tile manufactured by Engineered Plastics Inc. (800-682-2525) existing engineered and field tested products, which have been in successful service for a period of three (3) years are subject to compliance with requirements, may be incorporated in the work and shall meet or exceed the specified test criteria and characteristics.
- B. Color: Color shall be homogeneous throughout the tile. Tiles are available in Yellow conforming to Federal Color No. 33538, Light Grey (Federal Color No. 26280), Dark Grey (Federal Color No. 36118), Onyx Black (Federal Color No. 17038), Pearly White (Federal Color No. 37875), Brick Red (Federal Color No. 22144), Ocean Blue (Federal Color No. 15187), Ochre Yellow (Federal Color No. 23594), and Colonial Red (Federal Color No. 20109). Color to be selected by Architect.

PART 3. EXECUTION

3.01 INSTALLATION

- A. During Replaceable Cast In Place Detectable/Tactile Warning Surface Tile installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.
- B. Prior to placement of the Replaceable Cast In Place Detectable/Tactile Warning Surface Tile system, review manufacturer's instructions and contract drawings with the Contractor prior to the construction and refer any and all discrepancies to General Contractor.

- C. The specifications and related materials shall be in strict accordance with the contract documents and the guidelines set by their respective manufacturers. Not recommended for asphalt applications.
- D. The physical characteristics of the concrete shall be consistent with the contract specifications while maintaining a slump range of 4 - 7 to permit solid placement of the Replaceable Cast In Place Detectable/Tactile Warning Surface Tile system. An overly wet mix will cause the tile to float. Under these conditions, suitable weights such as sandbags shall be placed on tile.
- E. The concrete pouring and finishing operations require typical mason's tools, however, a 4' long level with electronic slope readout, and 10lb. sandbags are specific to the installation of the Replaceable Cast In Place Detectable/Tactile Warning Surface Tile system.
- F. The factory-installed plastic sheeting must remain in place during the entire installation process to prevent the splashing of concrete onto the finished surface of the tile.
- G. When preparing to set the tile, it is important that no concrete be removed in the area to accept the tile. It is imperative that that installation technique eliminates any air voids under the tile. Gaps in the tile perimeter allow air to escape during the installation process.
- H. The concrete shall be poured and finished true and smooth to the required dimensions and slope prior to the tile placement. Immediately after finishing concrete, the electronic level should be used to check that the required slope is achieved. The tile shall be placed true and square to the curb edge in accordance with the contract drawings. The Replaceable Cast In Place Detectable/Tactile Warning Surface Tiles shall be tamped (or vibrated) into the fresh concrete to ensure that the field level of the tile is flush to the adjacent concrete surface. The embedment process should not be accomplished by stepping on the tile as this may cause uneven setting which can result in air voids under the tile surface. The contract drawings indicate that the tile field level (base of truncated dome) is flush to adjacent surfaces to permit proper water drainage and eliminate tripping hazards between adjacent finishes.

- I. In cold weather climates it is recommended that the Replaceable Cast In Place Detectable/Tactile Warning Surface Tiles be set deeper such that the top of domes are level to the adjacent concrete on the top and sides of ramp. This installation will reduce the possibility of damage due to snow clearing operations. Care should be taken to finish the concrete on the side of the tile with the lower elevation, adding channels to allow water to drain from the field surface of the tile.
- J. Immediately after placement, the tile elevation is to be checked to adjacent concrete. The elevation and slope should be set consistent with contract drawings to permit water drainage to curb as the design dictates. Ensure that the field surface of the tile is flush with the surrounding concrete and back of curb so that no ponding is possible on the tile at the back side of curb.
- K. While concrete is workable, a 1/8" radius edging tool shall be used to create a finished edge of concrete, then a steel trowel shall be used to finish the concrete around the tile's perimeter, flush to the field level of the tile.
- L. During and after the tile installation and the concrete curing stage, it is imperative that there is no walking, leaning or external force placed on the tile that may rock the tile causing a void between the underside of tile and concrete.
- M. Following tile placement, review installation tolerances to contract drawings and adjust tile before the concrete sets. Suitable weights of 10 to 25 lb. each may be required to be placed on each tile as necessary to ensure solid contact of the underside of tile to concrete.
- N. Following the concrete curing stage, protective plastic wrap is to be removed from the tile surface by cutting the plastic with a sharp knife, tight to the concrete/tile interface. If concrete bled under the plastic, a soft brass wire brush will clean the residue without damage to the tile surface.
- O. Tiles can be cut to custom sizes, or to make a radius, using a continuous rim diamond blade in a circular saw or mini-grinder. Use of a straightedge to guide the cut is advisable where appropriate.

3.02 REPLACING TILES, PROTECTING AND MAINTENANCE

- A. Protect tiles against damage during construction period to comply with Tactile Tile manufacturer's specification.
- B. Protect tiles against damage from rolling loads following installation by covering with plywood or hardwood.
- C. Replace tiles by method specified by Tactile Tile manufacturer.
- D. Comply with manufacturer's maintenance manual for cleaning and maintaining tile surface. It is recommended to perform annual inspections for safety and tile integrity.

END OF SECTION 09614

SECTION 09650 - RESILIENT FLOORING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

- A. The extent of resilient flooring and accessories is shown on the drawings and in schedules.

1.03 QUALITY ASSURANCE:

- A. Wherever possible, provide resilient flooring and accessories produced by a single manufacturer.
- B. Fire Test Performance: Provide resilient flooring which complies with the following fire test performance criteria as determined by an independent testing laboratory acceptable to authorities having jurisdiction.
 - 1. Critical Radiant Flux (CRF): Not less than 0.45 watts per sq. cm. per ASTM E 648.
 - 2. Flame Spread: Not more than 75 per ASTM E 84.
 - 3. Smoke Developed: Not more than 450 per ASTM E 84.
 - 4. Smoke Density: Not more than 450 per ASTM E 662.

1.04 SUBMITTALS:

- A. Product Data:
 - 1. For information only, submit 2 copies of manufacturer's technical data and installation instructions for each type of resilient flooring and accessory. Transmit a copy of each installation instruction to the Installer.
- B. Samples:
 - 1. Submit 3 sets of samples of each type, color and finish of resilient flooring and accessory required. Provide full-size tile units and 6" long sample of accessory. Include full range of flooring color and pattern variation. Sample submittals will be reviewed for

color, texture and pattern only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

C. Maintenance:

1. Submit 2 copies of manufacturer's written instructions for recommended maintenance practices for each type of resilient flooring and accessories.

1.05 JOB CONDITIONS:

- A. Continuously heat areas to receive flooring to 70 degrees F. for at least 48 hours prior to installation, when project conditions are such that heating is required. Maintain 70 degrees F. temperature continuously during and after installation, as recommended by flooring manufacturer, but for not less than 48 hours.

1.06 EXTRA STOCK

- A. Deliver to the Owner, for his use in future modifications, an extra stock of approximately 10% of each color and pattern in each material installed under this Section, packaging each type of material separately, distinctly marked, and adequately protected against deterioration.

PART 2 - PRODUCTS

2.01 TILE FLOORING:

- A. Luxury Vinyl Tile: (Note: Multiple colors will be used in various patterns. Refer to drawings for additional info)
 1. Interface Level Set in color A00409, Ash Walnut, 1m x 25cm, install in Ashlar pattern.

2.02 ACCESSORIES:

- A. Resilient Moulding/Reducer/Floor Finishing Accessories:
 1. Provide vinyl carpet edge guards for glue down applications, nosings for resilient floor covering reducer strip for resilient floor covering, joiner for tile and carpet, or at junction between two dissimilar materials (new/new or new/existing), where shown on drawings and/or required.
 - a. Provide accessories as manufactured by Johnsonite,

as follows:

1. Carpet to sealed concrete: FG-XX-G
 2. PCT to carpet: CCA-XX
 3. VCT to carpet: CTA-XX-D
 4. Carpet to quarry tile: CWA-XX
- b. Color to be determined by Architect from manufacturer's standard colors.
- c. Install per manufacturer's standard specifications to maintain warranty.
- B. Adhesives (cements): As recommended by flooring contractor to suit material and substrate conditions.
- C. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Installer must examine the areas and conditions under which resilient flooring and accessories are to be installed and notify the General Contractor, in writing, of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 PREPARATION:

- A. Prior to laying flooring, broom clean or vacuum surfaces to be covered and inspect subfloor. Start of flooring installation indicates acceptance of subfloor conditions and full responsibility for completed work.
1. Use leveling compound as recommended by flooring manufacturer for filling small cracks and depressions in subfloors.
 2. Perform moisture tests on concrete slabs to determine that concrete surfaces are sufficiently cured and ready to receive flooring.
 3. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.

3.03 INSTALLATION:

A. General:

1. Install flooring after finishing operations, including painting, have been completed and permanent heating system is operating. Moisture content of concrete slabs, building air temperature, and relative humidity must be within limits recommended by flooring manufacturer.

2. Place flooring with adhesive cement in strict compliance with manufacturer's recommendations. Butt tightly to vertical surfaces, thresholds, nosing and edgings. Scribe around obstructions and produce neat joints, laid tight, even and straight. Extend flooring into toe spaces, door reveals and into closets and similar openings.

3. Maintain reference markers, holes or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other non-permanent marking device.

4. Maintain overall continuity of color and pattern with pieces of flooring installed in these covers. Tightly cement edges to perimeter of floor around covers and to covers.

5. Tightly cement flooring to subbase without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks or other surface imperfections.

B. Tile Floors:

1. Lay tile from center marks established with principal walls, discounting minor offsets, so that tile at opposite edges of the room are of equal width. Adjust as necessary to avoid use of cut widths less than 1/2 tile at room perimeters. Lay tile square to room axis, unless otherwise shown.

2. Match tiles for color and pattern by using tile from cartons in same sequence as manufactured and packaged. Cut tile neatly to around all fixtures. Broken, cracked, chipped or deformed tile are not acceptable.

C. Accessories:

1. Apply resilient base to walls, columns, pilasters, casework and other permanent fixtures in rooms or areas where base is required. Install base in as long lengths as practicable, with preformed corner units or fabricated from base materials with mitered or coped inside corners. Tightly bond base to backing throughout the length of each piece, with continuous contact at horizontal and vertical surfaces.
 - a. On masonry surfaces or other similar irregular surfaces, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
2. Place resilient edge strips tightly butted to flooring and secure with adhesive. Install edging strips at all unprotected edges of flooring, unless otherwise shown.

3.04 CLEANING AND PROTECTION:

- A. Remove any excess adhesive or other surface blemishes, using neutral type cleaners as recommended by flooring manufacturer. Protect installed flooring from damage by covering.
- B. Finishing: After completion of project and just prior to final inspection of work, thoroughly clean floors and accessories.
- C. Apply wax and buff with type of wax, number of coats and buffing procedures, in compliance with flooring manufacturer's instructions.

END OF SECTION 09650

SECTION 09680 - CARPETING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes
1. Sheet Carpet

B. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.02 SUBMITTALS

- A. Shop Drawings showing the extent of carpet, seam direction of carpet, and accessories shall be submitted to Architect for approval prior to installation. Check pattern match, if any, for matching during installation and possible waste factors in ordering required amounts. Should also indicate columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet. Copy of approved shop drawings to be available on job site during installation.
- B. Carpet schedule using same room designations indicated on drawings.
- C. Product Data: Provide data on specified products, describing physical and performance characteristics, sizes, patterns, colors available, and method of installation.
- D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial color selection.
- E. Verification Samples: Submit two 18" x 18" samples illustrating color and pattern for each carpet material specified.
- F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

- G. Maintenance Data: Include maintenance procedures, recommendations for maintenance materials and equipment, and suggested schedule for cleaning.
- H. Manufacturer's Carpet Warranty.
- I. Certification of Recycled Content and verification of reclamation and recycling program.
- J. Certifications: Manufacturer to submit copies of the following independent laboratory reports showing compliance with requirements per these methods outlined in Part 2 of this document. Submitted results shall represent average results for production goods of the specified style.
 - 1. ASTM E-648 Flooring Radiant Panel- Class 1 (mean avg CRF: 0.45w/sq cm or higher
 - 2. ASTM E-662: Smoke Density
 - 3. AATCC 134: Electrostatic Propensity - 3.0 kv or lower-permanent conductive fiber
 - 4. CRI TM-102: Fluorine Analysis - min 500 ppm after two AATCC 171: min. 400 ppm
 - 5. ASTM D-3936: Delamination

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications
 - 1. Company specializing in manufacturing specified carpet with minimum 10 years documented experience.
 - 2. Upon request, manufacturer to provide representative to assist in project start-up and to inspect installation while in process and upon completion. Representative will notify designated contact if any installation instructions are not followed.
 - 3. Single Source Responsibility: Obtain each type of carpet from one source and by a single manufacturer.
- B. Installer Qualifications
 - 1. Flooring contractor must be certified by the carpet manufacturer prior to bid.

2. Flooring contractor to be a specialty contractor normally engaged in this type of work and shall have prior experience in the installation of these types of materials.
3. Flooring contractor possessing Contract for the carpet installation shall not sub-contract the labor without written approval of the General Contractor.
4. Flooring contractor will be responsible for proper product installation, including floor testing and preparation as specified by the carpet manufacturer and JOB CONDITIONS herein.
5. Flooring contractor to provide Owner a written installation warranty that guarantees the completed installation to be free from defects in materials and workmanship for a period of one year after job completion.

1.04 DELIVERY, STORAGE, & HANDLING

- A. Deliver materials to the site in manufacturer's original packaging listing manufacturer's name, product name, identification number, and related information.
- B. Store in a dry location, between 60 degrees F and 80 degrees F and a relative humidity below 65%. Protect from damage and soiling. Stack carpet rolls horizontally on a flat surface, stacked no higher than two rolls.
- C. Make stored materials available for inspection by the Owner's representative.
- D. Store materials in area of installation for minimum period of 48 hours prior to installation.

1.05 PROJECT CONDITIONS

- A. Sub-floor preparation is to include all required work to prepare the existing floor for installation of the product as specified in this document and Manufacturer's installation instructions.
- B. The maximum amount of moisture evacuation from the floor is 3.0 pounds per 1,000 square feet in 24 hours. The acceptable pH level of the substrate is between 7.0 and 9.0. Flooring contractor is responsible for floor testing.

- C. All material used in sub-floor preparation and repair shall be recommended by the carpet manufacturer and shall be chemically and physically compatible with the carpet system being bid.
- D. Maintain minimum 65 degrees F ambient temperature and 65% Relative Humidity for 72 hours prior to, during, and 48 hours after installation.
- E. Do not install carpet until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

PART 2 - PRODUCTS

2.01 PRODUCT RECYCLABILITY

- A. Product must meet FTC guides for recyclability and must be one hundred percent (100%) closed-loop recyclable back into carpet. Products containing both recyclable and non-recyclable components, manufacturer must adequately report which portions of the product are recyclable per FTC guides 16 CFR section 260.7(d). Note: A manufacturer cannot claim that a product or any portion of a product that is incinerated is recyclable, even if incineration is used to produce heat and power (i.e. waste-to-energy) per FTC guides 16 CFR section 260.7 (d) example 3.
- B. Recyclability of product installed must be the same as that claimed by manufacturer and required by Project requirements.

2.02 RECYCLING PROGRAM

- A. Manufacturer must have a collection and recovery system for product and a fully established, currently operational recycling program at time of bid per FTC guides Section 260.7 (d).
- B. Manufacturer must be able to reclaim and recycle 100% of existing carpet of similar composition back into carpet at time of bid.

- C. Manufacturer must have product a take back program and be able to reclaim and recycle 100% of installed product back into carpet at the end of its service life at time of bid. Claiming a product is recyclable based on future expectation of technology, equipment, process or availability of that product as feed stock is not acceptable. Recycling process must be available for viewing.
- D. Collection and recycling program must be verified by an independent, neutral third-party organization, such as Scientific Certification Systems.
- E. Manufacturer must have written guarantee that 100% of the recovered product will be recycled and that no portion of the product will be landfilled or incinerated (including waste-to-energy).

2.03 MANUFACTURER'S ENVIRONMENTAL COMMITMENT

- A. A manufacturer's environmental commitment will be reflected by its corporate culture and measured by the goals, policies and programs that have been instituted to improve the environmental performance of its operations. Evidence of this commitment must include:
 - 1. All products produced by the manufacturer must meet FTC guides for recyclability and be 100% recyclable in a fully established, currently operational recycling program 16 CFR section 260.7 (d).
 - 2. All products produced by the manufacturer, including recycled content products, must be 100% closed-loop recyclable back into carpet.
 - 3. Manufacturer must show evidence of a positive and continuing improvement in source reduction and the reduction of energy, water, waste and air emissions.
 - 4. Manufacturer must fully comply with FTC Part 260 "Guides for the Use of Environmental Marketing Claims," with respect to advertising, labeling, product inserts, catalogs and sales presentations of all its carpet products submitted and sold. Certification signed by an officer of the manufacturer stating the manufacturer complies with these guides maybe required for submittal upon request.

2.04 INDOOR AIR QUALITY

A. Product must have low VOC, factory applied, "dry" adhesive.

B. Product, inclusive of floor covering adhesive, must meet CRI's IAQ requirements for carpet only. Environmental chamber testing per ASTM D-5116. Emission Rates determined at 24 hours. Product, inclusive of pre-applied adhesive must off gas less than:

0.5 mg/sq. meter per hour of Total Volatile Organic Compound (TVOC);
0.05 mg/sq. meter per hour of formaldehyde;
0.4 mg/sq. meter per hour of styrene; and
0.05 mg/sq. meter per hour of 4-Phenyl Cyclohexene (4-PC)

1. Submit Indoor Air Quality report showing CRI Green label Certification Number for carpet (inclusive of adhesive). [If results for carpet testing are not inclusive of adhesive, submit separate IAQ test reports for carpet and adhesive].
2. Indoor air quality results of the product installed must be same as those specified by the Project requirements.
3. Additionally, product, inclusive of adhesive, must meet the requirements of the State of Washington Indoor Air Quality Specifications for Carpet at 24 hours. Environmental chamber testing per ASTM D-5116. Product must not require the 30-day air out period that the State of Washington protocol allows.

2.05 CARPET WARRANTY

A. Warranty to be sole source responsibility of the Manufacturer. Second source warranties and warranties that involve parties other than the carpet manufacturer are unacceptable.

B. If the product fails to perform as warranted when properly installed and maintained, the affected area will be repaired or replaced at the discretion of the Manufacturer.

C. Chair pads are not required, but are recommended for optimum textural performance. Absent the use of chair pads, more intensive maintenance will be required for areas in direct contact with chair caster traffic, and some degree of appearance change is to be expected.

- D. Warranty shall be for a specifically defined non-prorated period of (25) twenty-five years. Lifetime" warranties are not acceptable. More intensive maintenance will be required for product installed on stairs, and some degree of appearance change is to be expected.
- E. Warranty shall not exclude carpet product installed on stairs provided it is properly installed and maintained.
- F. The non-prorated (25) twenty-five years warranty shall specifically warrant against :
1. Excessive Surface Wear: More than 15% loss of pile fiber weight
 2. Excessive Static Electricity: More than 3.0 kV per AATCC 134
 3. Resiliency Loss of the Backing: More than 10% loss of backing resiliency
 4. Delamination
 5. Edge Ravel
 6. Zippering
- G. Tuft Bind warranty in lieu of edge ravel and zippering is not acceptable.

2.06 FIBER

- A. Nylon Fiber: Solution Dyed, Bulked Continuous Filament (BCF) Nylon Bulked Continuous Filament (BCF) Nylon in a loop pile construction. Cut pile is not acceptable.
- B. Report fiber type (i.e. EPP Certified Invista Antron, SAVANT, etc,)
- C. Report post consumer and post industrial recycled content of the pile face yarn in product based on weight i.e. [(Recycle Content in Pile Face Yarn) / (Total Weight of Pile Face Yarn) x 100]
- D. Fiber to contain carbon-core filament for permanent static control. Topical treatments are not acceptable.
- E. Durable stain inhibitor should be applied to the fiber during product manufacturing to resist fiber staining and soiling.
1. Initial: Minimum 500 ppm Fluorine per CRI TM-102
 2. After two hot water extractions per AATCC 171: Minimum 400 ppm Fluorine per CRI TM-102

2.09 MANUFACTURING SPECIFICATIONS

A. Specified Floorcoverings:

1. Field Carpet: Offices and Reading Room
 - a. Interface Kerbstone carpet tiles, Style: 286402500 in color Granite 105572.
 - b. Install non-directional.
2. Walk Off Carpet: Vestibule.
 - a. Shaw Welcome II, 5T031, in color Charcoal 31549.

2.10 ACCESSORIES

- A. Materials recommended by Manufacturer for patching, priming, seam welding, etc.
- B. Adhesives: Products to be supplied with a low VOC, factory applied, "dry" adhesive for "peel and stick" installation.
- C. Base, Carpet Edge, and Transition Strips: As specified in applicable sections.

PART 3 EXECUTION

3.01 EXAMINATION / PREPARATION

- A. Prepare sub-floor to comply with criteria established in Manufacturer's installation instructions. Use only preparation materials that are acceptable to the Manufacturer.
 1. Remove all deleterious substances from substrate(s) that would interfere with or be harmful to the installation (i.e. floor wax).
 2. Remove sub-floor ridges and bumps. Fill cracks, joints, holes, and other defects.
- B. Verify that sub-floor is smooth and flat within specified tolerances and ready to receive carpet.
- C. Verify that substrate surface is dust-free and free of substances that would impair bonding of product to the floor.

- D. Verify that concrete surfaces are ready for installation by conducting moisture and pH testing. Results must be within limits recommended by Manufacturer.
- E. There will be no exceptions to the provisions stated in the Manufacturer's installation instructions.

3.02 INSTALLATION - GENERAL

- A. Install product in accordance with Manufacturer's installation instructions.
- B. Verify carpet match before cutting to ensure minimal variation between dye lots.
- C. Layout carpet and locate seams in accordance with shop drawings.
 - 1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic. Minimize cross seams.
 - 2. Do not locate seams perpendicular through door openings.
 - 3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
 - 4. Locate change of color or pattern between rooms under door centerline.
 - 5. Provide monolithic color, pattern, and texture match within any one area.
- D. Install carpet tight and flat on sub-floor, well-fastened at edges, with a uniform appearance.
- E. Double-cut carpet seams with accurate pattern match. Make cuts straight, true, and unfrayed.
- F. Chemically weld all seams with manufacturer's recommended seam sealer as stated in installation instructions. Make sure the seam is fully sealed.
- G. Roll with appropriate roller for complete contact of carpet with mill-applied adhesive to sub-floor.
- H. Trim carpet neatly at walls and around interruptions.

- I. Completed carpet is to be smooth and free of bubbles, puckers, and other defects.

3.03 PROTECTION & CLEANING

- A. Remove excess adhesive and/or seam sealer from floor and wall surfaces without damage.
- B. All rubbish, wrappings, debris, trimmings, etc. to be removed from site and recycled or disposed of properly.
- C. Clean and vacuum carpet surfaces using a beater brush/bar commercial vacuum.
- D. After each area of carpet is installed, protect from soiling and damage by other trades.

END OF SECTION 09680

SECTION 09900 - PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.2 DESCRIPTION OF WORK:

- A. The extent of painting work is shown on the drawings and schedules, and as herein specified. (Note: Multiple colors, both field & accent colors will be used at each area or space)
- B. The work includes painting and finishing of interior and exterior exposed items and surfaces throughout the project, except as otherwise indicated.
- C. The work includes field painting of exposed bare and covered pipe and ducts (excluding color coding), and of hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under the mechanical and electrical work, except as otherwise indicated.
- D. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of work.
- E. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers and other applied materials, whether used as prime, intermediate or finish coats.
- F. Paint all exposed surfaces in areas designated "paint" in "schedules," except where the natural finish of the material is specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint them the same as adjacent similar materials or areas.

1.3 PAINTING NOT INCLUDED:

- A. The following categories of work are not included as part of the field-applied finish work, or are included in other sections of these specifications:
1. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under the various sections for structural steel, miscellaneous metal, hollow metal work, and similar items.
 2. Pre-Finished Items: Unless otherwise indicated, do not include painting when factory-finishing or installer finishing is specified for such items as (but not limited to) metal toilet enclosures, acoustic materials, casework, finished mechanical and electrical equipment including light fixtures, switchgear and distribution cabinets, but not light or power panels where exposed elevator entrance frames, doors and equipment.
 3. Concealed surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, foundation spaces, furred areas, utility tunnels, pipe spaces, duct shafts and elevator shafts.
 4. Finished Metal Surfaces: Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting, unless otherwise indicated.
 5. Operating Parts and Labels:
 - a. Moving parts of operating units, mechanical and electrical parts such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting unless otherwise indicated.

- b. Do not paint over any code-required labels, such as Underwriters', Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.

1.4 DELIVERY AND STORAGE:

- A. Deliver all materials to the job site in original, new and unopened packages and containers bearing manufacturer's name and label, and the following information:
 - 1. Name or title of material.
 - 2. Fed. Spec. Number, if applicable.
 - 3. Manufacturer's stock number and date of manufacturer.
 - 4. Manufacturer's name.
 - 5. Contents by volume, for major pigment and vehicle.
 - 6. Constituents.
 - 7. Thinning instructions.
 - 8. Application instructions.
 - 9. Color name and number.

1.5 JOB CONDITIONS:

- A. Apply water-base paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 50 degrees F. and 90 degrees F., unless otherwise permitted by the paint manufacturer's printed instructions.
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 45 degrees F. and 95 degrees F. unless otherwise permitted by the paint manufacturer's printed instructions.
- C. Do not apply paint in snow, rain, fog or mist; or when the relative humidity exceeds 85% or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instructions.

1. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.1 MANUFACTURER:

- A. Basis of Design: PPG Paints 23361 Telegraph Road, Southfield, MI 48034 Contact: Jim Kacir Phone: (248) 520-9864. Web Site: www.ppghpc.com

2.2 COLORS AND FINISHES:

- A. Prior to beginning work, the Architect will furnish color chips for surfaces to be painted. Colors will vary from wall to ceiling and from room to room. Final selection for gloss level will be by Architect and may not necessarily be the same as scheduled.
 1. Use representative colors when preparing samples for review.
 2. Final acceptance of colors will be from samples applied on the job.
- B. Color Pigments: Pure, non-fading, applicable types to suite the substrates and service indicated.
- C. Paint Coordination: Provide finish coats which are compatible with prime paints used. Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Upon request from other trades, furnish information on characteristics of finish materials proposed for use, to ensure compatible prime coats are used. Provide barrier coats over incompatible primers or remove and reprime as required. Notify the Architect in writing of any anticipated problems using specified coating systems with substrates primed by others.

2.3 EXTERIOR PAINT SYSTEMS:

A. Metal-Galvanized and Ferrous (Semi-Gloss):(Acrylic Latex System).

1. Finish Coats: 100 percent acrylic, Waterborne, Semi-Gloss (30-40 units at 60 degrees F.),3.0 mils DFT/coat.
Benjamin Moore: (2) coats DTM acrylic semi-gloss (M29)

B. Metal-Heat Resistant:(Maximum Temperature 1,000 degrees F.) (VOC 650)

1. Primer: Silicone Alkyd, .75 mils DFT/coat.
Benjamin Moore: (1) coat high heat zinc (M66-77)
2. Finish Coats: Silicone Alkyd, Aluminum Bright, .75-1.0 mils DFT/coat.
Benjamin Moore: (1) coat high heat zinc (M66-78)

C. Concrete/Masonry Surfaces (Semi-Gloss)

1. Primer: 100 percent Acrylic Resin Block Filler, .075 - 1.0 DFT/coat.
Benjamin Moore: Waterborne block filler (M31/32)
2. Finish Coats: Water Based Epoxy, Semi-Gloss (20-30 units at 60 degrees F.) 3 mils DFT/coat.
Benjamin Moore: (2) coats acrylic epoxy (M43/44)

2.4 INTERIOR PAINTING SCHEDULE:

A. Concrete/Masonry Surfaces (Semi-Gloss) (Vinyl Acrylic Latex System)

1. Primer: Vinyl Acrylic Block Filler
Benjamin Moore: Moorcraft interior and exterior block filler #173
2. Finish Coats: Vinyl Acrylic Semi-Gloss Enamel (25-35 units at 60 degrees F.), 1.5 DFT/coat.
Benjamin Moore: (2) coats Moorcraft latex semi-gloss enamel #1416

- B. Concrete/Masonry Surfaces (Semi-Gloss): (Water Based Epoxy - Normal Exposure)
1. Primer: 100 percent Acrylic Resin Block Filler, .075 - 1.0 DFT/coat.
Benjamin Moore: Waterborne block filler (M31/32)
 2. Finish Coats: Water Based Epoxy, Semi-Gloss (20-30 units at 60 degrees F.) 3 mils DFT/coat.
Benjamin Moore: (2) coats acrylic epoxy (M43/44)
- C. Concrete Floor Surfaces - Epoxy Paint
1. Two component 100% (+/- 1%) solids epoxy color coating.
 - a. Epoxy paint for floor and (where indicated to be painted) base shall be: Norklad 100 two component 100% solids epoxy broadcast coat 16-18 mils DFT with marble chip flakes (color to be selected from manufacturer's standard colors by Architect) over Norklad 200 100% solids epoxy base coat 12-30 mils DFT. Provide with manufacturer's recommended primer and urethane top coat.
 - b. Prepare floor per SSPC SP13 and manufacturer's specifications.
 - c. Norklad Products - Manufactured by: Original Color Chips Company, 26200 Groesbeck Hwy, Warren, MI 48089, 1-800-227-8479 or 1-586-771-6500.
- D. Metal-Ferrous (Semi-Gloss): (Alkyd Enamel System, Maximum VOC content 450 grams/liter)
1. Primer: Modified Alkyd Resin Primer, 3 mils DFT/coat
Benjamin Moore: iron clad retardo rust inhibitive paint, 163
 2. Finish Coats: Alkyd Enamel, Semi-Gloss (40-50 units at 60 degrees F.) 3.0 mils DFT/coat.
Benjamin Moore: (2) coats satin impervo

- E. Metal - Galvanized (Semi-gloss): Code #5.13 (Acrylic Latex System)
1. Finish Coats: 100 percent Acrylic, Waterborne, Semi-Gloss (30-40 units at 60 degrees F.) 3.0 mils DFT/coat.
Benjamin Moore: (2) coats DTM acrylic semi-gloss (M2a)
- F. Gypsum Board (Eggshell): (Acrylic Latex System)
1. Primer: Vinyl Acrylic Latex, 1.1 mils DFT/coat
Benjamin Moore: Moorcraft undercoater (284)
 2. Finish Coats: Vinyl Acrylic Semi-Gloss (25-35 units at 60 degrees F.), 1.5 mils DFT/coat.
Benjamin Moore: (2) coats Moorcraft latex semi gloss (276)
- G. Gypsum Board (Eggshell): (Water Based Epoxy System)
1. Primer: Vinyl Acrylic Latex, 1.1 mils DFT/coat
Benjamin Moore: Moorcraft undercoater (284)
 2. Finish Coats: Water Based Catalyzed Epoxy, Semi-Gloss (20-30 units at 60 degrees F.), 2.5 - 3.0 mils DFT/coat.
Benjamin Moore: (2) coats acrylic epoxy (M43/44)
- H. Painted Woodwork:
- a. 1st Coat-Enamel undercoat (TT-S-543)
 - b. 2nd Coat-Alkyd enamel (TT-E-509)
 - c. 3rd Coat-Alkyd enamel (TT-E-509)
- I. Stained Woodwork:
- a. 1st Coat-Interior oil stain (TT-S-711)
 - b. 2nd Coat-Bleached shellac (TT-S-300)
 - c. 3rd Coat-Rubbing varnish (TT-V-86)
 - d. 4th Coat-Rubbing varnish (TT-V-86)
 - e. Fill open grained wood with filler complying with TT-F-336 and wipe before first varnish coat.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Applicator must examine the areas and conditions under which painting work is to be applied and notify the Construction Manager in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Applicator.
- B. Starting of painting work will be construed as the Applicator's acceptance of the surfaces and conditions within any particular area.
- C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to the formation of a durable paint film.

3.2 SURFACE PREPARATION:

- A. General:
 1. Perform preparation and cleaning procedure in strict accordance with the paint manufacturer's instructions and as herein specified for each particular substrate condition.
 2. Remove all hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary for the complete painting of the items and adjacent surfaces. Following completion of painting of each space or area, reinstall the removed items by workmen skilled in the trades involved.
 3. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program the cleaning and painting so that contaminants from

the cleaning process will not fall onto wet, newly-painted surfaces.

B. Cementitious Materials:

1. Prepare cementitious surfaces to be painted by removing all efflorescence, chalk, dust, grease, oils, and by roughening as required to remove glaze conforming to SSPC13.
2. Determine the alkalinity and moisture content of the surfaces to be painted by performing appropriate tests. If the surfaces are found to be sufficiently alkaline to cause blistering and burning of the finish paint, correct this condition before application of paint. Do not paint over surfaces where the moisture content exceeds that permitted by the manufacturer's printed directions.

C. Wood:

1. Clean wood surfaces to be painted of all dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer before application of the priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sandpaper smooth when dried.
2. Prime, stain, or seal wood required to be job painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases, paneling, etc.
3. When transparent finish is required, use spar varnish for backpriming.
4. Seal tops, bottoms, and cut-outs of unprimed wood

doors with a heavy coat of varnish or equivalent sealer immediately upon delivery to job.

D. Ferrous Metals:

1. Clean ferrous surfaces, which are not galvanized or shop-coated of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning conforming to SSPC SP-1 and SSPC SP-2, SSPC-SP-3 or SSPC-SP7 NACE-No. 4 (brush off blast cleaning).

E. Galvanized Surfaces:

1. Clean free of oil and surface contaminants with an acceptable non-petroleum based solvent per SSPC SP-1.

3.3 MATERIALS PREPARATION:

- A. Mix and prepare painting materials in accordance with manufacturer's directions.
- B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue.
- C. Stir materials before application to produce a mixture of uniform density and stir as required during the application of the materials. Do not stir surface film into the material. Remove the film and if necessary, strain the material before using.

3.4 APPLICATION:

A. General:

1. Apply paint in accordance with the manufacturer's directions. Use applicators and techniques best suited for the substrate and type of material

being applied.

2. Apply additional coats when undercoats, stains or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance. Give special attention to insure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
3. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Paint surfaces behind permanently-fixed equipment or furniture with prime coat only before final installation of equipment.
4. Paint interior surfaces of ducts where visible through registers or grilles with a flat, non-specular black paint.
5. Paint the back sides of access panels and removable or hinged covers to match the exposed surfaces.
6. Finish exterior doors on tops, bottoms and side edges the same as the exterior faces, unless otherwise indicated.
7. Sand lightly between each succeeding enamel or varnish coat.
8. Omit the first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise indicated.

B. Scheduling Painting:

1. Apply the first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
2. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until

paint has dried to where it feels firm, does not defore or feel sticky under moderate thumb pressure and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

C. Minimum Coating Thickness:

1. Apply each material at not less than the manufacturer's recommended spreading rate to establish a total dry film thickness as indicated or, if not indicated, as recommended by coating manufacturer.

D. Mechanical and Electrical Work:

1. Painting of mechanical and electrical work is limited to those items exposed in occupied spaces and includes all exterior exposed work.

E. Prime Coats:

1. Apply a prime coat of material which is required to be painted or finished, and which has not been prime coated by others.
2. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

F. Pigmented (Opaque) Finishes:

1. Completely cover and provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.

G. Transparent (Clear) Finishes:

1. Use multiple coats to produce glass-smooth

surface film of each luster. Provide a finish free of laps, cloudiness, color, irregularity, runs, brush marks, orangpeel, nail holes, or other surface imperfections.

2. Provide satin finish for final coats, unless otherwise indicated.

H. Completed Work:

1. Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

3.5 CLEAN-UP AND PROTECTION:

A. Clean-up:

1. During the progress of the work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each work day.
2. Upon completion of painting work, clean window glass and other paint- spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care no to scratch or otherwise damage finished surfaces.

B. Protection:

1. Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing and repainting, as acceptable to the Architect.
2. Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.
3. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

END OF SECTION 09900

SECTION 10200 - ARCHITECTURAL LOUVERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1 General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

- A. The extent of architectural louvers is shown on the drawings, including notes and details, indicating the size and location of all units.
- B. Related Work Specified Elsewhere:
 - 1. Joint Fillers & Gaskets and Sealants and Caulking:
Sections 07910 and 07920.
 - 2. Blank-off plates at air-handling louvers: Division 15.

1.03 QUALITY ASSURANCE:

- A. Comply with SMACNA (Sheet Metal and Air Conditioning Contractor's National Association) "Architectural Sheet Metal Manual" recommendations for fabrication, construction details, and installation procedures, except as otherwise indicated.
- B. Verify size, location and placement of louver units prior to fabrication wherever possible. Coordinate field measurements and shop drawings with fabrication and shop assembly to minimize field adjustments, splicing mechanical joints and field assembly of units. Preassemble units in as large sections as practicable.

1.04 SUBMITTALS:

- A. Product Data:
 - 1. For information only, submit 2 copies of manufacturer's technical data, anchor details and installation instructions including finishing products. Transmit installation instructions to the Installer.

B. Shop Drawings:

1. Submit shop drawings for the fabrication and erection of louver assemblies. Include details of sections and connections. Show anchorage items.

C. Samples:

1. Submit 3 samples, 6" square, of metal finish to be used in the work. Prepare samples on metal of the same gage and alloy to be used in the work. Samples will be reviewed for color and texture only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by the metal producer to provide the required finish.
- B. Aluminum Extrusions: ASTM B 221, Alloy 6063- T52.
- C. Fastenings: Use same material as items fabricated, unless otherwise indicated. Fasteners for exterior applications may be hot-dip galvanized, stainless steel or aluminum. Provide types, gages and lengths to suit unit installation conditions. Use Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.
- D. Anchors and Inserts: Use non-ferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.
- E. Bituminous Paint: SSPC-Paint 12 (cold-applied asphalt mastic).

2.02 EXTRUDED ALUMINUM LOUVERS:

- A. Furnish extruded aluminum louvers, with extrusions not less than 0.081" thick, of sizes indicated.
- B. Fabricate frames to suit adjacent construction.
- C. Assemble louvers and provide all supports, anchorages and accessories for complete installation.
- D. Locate sills where shown, of the same material and thickness as louvers.
- E. Finish exposed-to-view aluminum surfaces as follows:
 - 1. Fluoropolymer Coating: Pretreat aluminum surfaces as recommended by manufacturer of coating, including conversion coating. Apply 2-coat system and bake coatings at processing plant in accordance with manufacturer's instructions to match color and specular gloss of Architect's sample, and to comply with AAMA 605.1 and the following:
 - a. Dry Film Thickness: Not less than 1.2 mils, as proven by suitable tests on representative coupon samples prepared during course of application.
 - b. Composition: A minimum of 33% (by volume) of crystalline, high molecular weight, thermoplastic polymer of vinylidene fluoride (59% fluorine by weight), together with pigments, vehicles, and other compounds as recommended by coating manufacturer.
 - 2. Gloss: Medium at 60 degrees, ASTM D 523.

2.03 SCREENS:

- A. Provide removable screens for exterior louvers.
- B. Fabricate screen frames of the same metal and finish as the louver units to which secured.
- C. Provide frames consisting of U-shaped metal for permanently securing screen mesh.
- D. Use 1/2" sq. mesh, 0.064" anodized aluminum wire bird screen.

- E. Locate screens on inside face of louvers. Secure screens to Louver frames with machine screws, spaced at each corner and at 12" o.c. between.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Installer must examine the areas and conditions under which louvers and associated items are to be installed and notify the General Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 PREPARATION:

- A. Coordinate setting drawings, diagrams, templates, instructions and directions for the installation of anchorages which are to be embedded in concrete or masonry construction. Coordinate the delivery of such items to the project site.

3.03 INSTALLATION:

- A. Locate and place louver units plumb, level and in proper alignment with adjacent work.
- B. Use concealed anchorages wherever possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers, as indicated.
- D. Repair finishes damaged by cutting, welding, grinding operations required for fitting and jointing. Restor finishes and prime coats of paint so that there is no evidence of corrective work. Return items which cannot be refinished in the field to the shop, make the required alterations, and refinish the entire unit, to provide new units, at Contractor's option.
- E. Protect galvanized and non-ferrous metal surfaces from corrosion or galvanic action by application of a heavy coating of bituminous paint on surfaces which will be in contact with concrete, masonry or dissimilar metals.

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- F. Provide concealed gaskets, flashings, joint fillers, and insulations, and install as the work progresses to make the installations weathertight.
- G. Refer to Section 07920 for sealants in connection with the installation of louvers.

END OF SECTION 10200

SECTION 10400 - IDENTIFICATION DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.02 SUMMARY

- A. Provide labor, materials, and equipment necessary for the complete installation of identifying devices as indicated, including:
 - 1. Interior Signage
 - 2. Exterior Pin Mounted Signage

1.03 SUBMITTALS:

- A. Submit product data for each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- B. Submit Shop Drawings showing fabrication and erection of signs. Include plans, elevations, and large scale sections of typical members and other components. Show anchors, grounds, layout, reinforcement, accessories, and installation details.
- C. Signage shall have 2 colors, background and letters. Match sample provided by Architect.
- D. Provide samples for verification of color, pattern, and texture selected and compliance with requirements indicated:
 - 1. Cast Acrylic Sheet: Provide a sample panel not less than 8-1/2 inches by 11 inches for each material, color, texture, and pattern required. On each panel include a representative sample of the graphic image process required, showing graphic style, and colors and finishes of letters, numbers, and other graphic devices.

1.04 QUALITY ASSURANCE:

- A. Reference Codes and Specifications: Standard Building Code.
- B. Signage shall be provided to conform with the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations.

PART 2 - PRODUCTS

2.01 MANUFACTURER:

- A. Manufacturers: (Interior Signage) Subject to compliance with requirements, provide signage by one of the following:
 - 1. ASI Sign Systems, Indianapolis, Indiana; Cincinnati, Ohio; Cleveland, Ohio
 - 2. Jacob Design, Grand Rapids, Michigan
 - 3. Diskey Sign Corp. Fort Wayne, Indiana
 - 4. Andco Industries Corp. Greensboro, North Carolina
 - 5. Southwell Company, San Antonio, Texas
 - 6. Roban, Lakemore, Ohio
 - 7. Best Signs, Montrose, Colorado
 - 8. Bayuk Graphic Systems, Inc. (CW Series)
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for Architect's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Project Manager and Specification Department at least 10 days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
 - 1. Refer to Section 00100 - Instructions to Bidders and Section 00121 - Substitution Request Form for additional requirements.

2.02 MATERIALS:

- A. Cast Acrylic Sheet: Provide cast (no extruded or continuous cast) methyl methacrylate monomer plastic sheet, in sizes and thicknesses indicated, with a minimum flexural strength of 16,000 psi when tested according to ASTM D 790, with a minimum allowable continuous service temperature of 176 degrees F and of the following general types:
 - 1. Thickness: 1/8 inch.
 - 2. Colors as specified.

- B. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.
- C. Anchors and Inserts: Use nonferrous metal or hot dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete masonry work.
- D. Colored Coatings for Acrylic Plastic Sheet: Use colored coatings, including inks and paints for copy and background color that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for the application intended.

2.03 INTERIOR SIGNAGE:

A. Signage, General:

- 1. Graphic Process; Raised letters and Braille shall be formed as an integral part of the sign face. Surface applied letters and Braille are not allowed.
- 2. Letters: Letters and numbers shall have width to height ratio between 3:5 and 1:1 and a stroke width to height ratio between 1:5 and 1:10. Letters and numbers shall be raised 1/32 inch, uppercase, sans serif or simple sans serif type and shall be accompanied with Grade 2 Braille. Raised characters shall be 5/8 inch high minimum and 2 inches high maximum.
- 3. Ease sign edge and radius corners 3/8 inch.
- 4. Material
 - a. Acrylic plastic
- 5. Size: 8" x 8" or match existing sign sizes and profiles in building.

B. Toilet Room Handicapped Signs

- 1. Provide one sign depicting International Men/Women Symbol along with the words "Men" or "Women" indicated on the sign at each toilet room, equipped with facilities for the handicapped as indicated on the Signage Schedule.

2.04 EXTERIOR PIN MOUNTED SIGNAGE:

- A. Provide 1-3/4" minimum mounted distance/projection from the wall face (mounting type PMS-3). Provide with all required stainless steel accessories for a complete installation.
- B. Letter size = 6" high as indicated below and/or as shown on elevations. Font style to be Helvetica.
- C. Color of letters and numerals - TBD.
- C. Provide letters based on Metal Arts Metal Letters - Phone: (1-800-237-8069) or equal.
- D. Provide lettering as follows: Exact locations to be determined.

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PART 3 - EXECUTION

3.01 INSTALLATION:

- A. General: Located sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
 - 1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.
- B. Wall Mounted Panel Signs: Attach panel signs to wall surfaces using the method indicated below:
 - 1. Mount with adhesive as recommended by manufacturer.
 - 2. Mount with nonremovable oval head screws, using plastic plugs where mounted on masonry.
 - 3. For signs mounted to glass panels. Provide an additional solid panel on the back of the glass to conceal fastening methods from view. Panel to be solid in same color and overall size as the front facing sign.

3.02 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

END OF SECTION 10400

SECTION 10522 - FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

- A. The extent of fire extinguishers and cabinets is shown on the drawings.

1.03 QUALITY ASSURANCE:

- A. Manufacturer: Provide fire extinguishers and cabinets manufactured by one of the following:

- 1. J. L. Industries
- 2. Larsens Manufacturing Company
- 3. Potter Roemer
- 4. Nystrom

1.04 SUBMITTALS:

- A. Manufacturer's Data:

- 1. For information only, submit two (2) copies of manufacturer's technical data and installation instructions for fire extinguisher cabinets required. Transmit copy of each instruction to the installer.

PART 2 - PRODUCTS

2.01 FIRE EXTINGUISHERS AND CABINETS:

- A. General: Provide fire extinguisher cabinets including standard 10 lb. multi-purpose dry chemical fire extinguishers, as follows:

- 1. Semi-Recessed, 1-1/2" return trim door frame similar to J.L. Industries Cosmopolitan Model #1036 with solid door.

- B. Metal Gage: Provide cabinets fabricated of the following minimum equivalent steel gages.
 - 1. Box: 20 gage.
 - 2. Trim Frame: 18 gage.
 - 3. Tubular Door Perimeter Frame: 20 gage:
- C. Construction: One-piece tubular door frames, mitered and welded. One-piece metal trim frame, to suit cabinet style required. Weld all joints and grind smooth. Provide manufacturer's standard steel box with white baked enamel interior finish.
- D. Steel Doors and Trim: Manufacturer's standard, #4 stainless steel door frame and trim, style as indicated.
- E. Door Hardware: Continuous type hinge permitting door to open 180 degrees. Provide Futura "fire handle".
- F. Provide fire-rated cabinets where indicated on plan or if not indicated, at all locations installed in a fire-rated wall as shown on the life safety plan.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Installer must examine the substrates and conditions under which the fire extinguisher cabinets are to be installed, and notify the General Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 INSTALLATION:

- A. Install in locations and at mounting height to comply with governing authorities. Prepare recesses in walls as required. Securely fasten to structure, square and plumb, in accordance with manufacturer's instructions.

END OF SECTION 10522

SECTION 10800 - TOILET ACCESSORIES

PART I - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION:

- A. The extent of each type of toilet accessory is shown on the drawings.
- B. The type of toilet accessories required, provided and installed by the contractor include the following:
 - 1. Soap dispenser
 - 2. Sanitary Napkin Disposal
 - 3. Toilet tissue dispensers
 - 4. Towel Dispensers/Disposal
 - 5. Mirrors
 - 6. Grab bars
 - 7. Electric hand dryers
 - 8. Misc. Accessories
 - 9. Baby Changing Station

1.03 QUALITY ASSURANCE:

- A. Inserts and Anchorages:
 - 1. Furnish inserts and anchoring devices which must be built into masonry for the installation of toilet accessories. Coordinate delivery with other work to avoid delay.
 - 2. See masonry sections of these specifications for installation of inserts and anchorage devices.
- B. Products:
 - 1. Provide products of the same manufacturer for units exposed in the same areas, unless otherwise acceptable

to the Architect.

2. Stamped names or labels on exposed faces of units will not be permitted, except where otherwise indicated.
 3. Provide locks where indicated, with the same keying for each type of accessory units in the project wherever possible. Furnish two keys for each lock.
- C. The specifications indicated specific products of one manufacturer to communicate design intent. Other manufacturers offering products to comply with the requirements for toilet accessories include the following:
1. American Specialties, Inc.
 2. Accessory Specialties.
 3. Bradley Corporation
 4. Bobrick
 5. Spartan
 6. Extreme Air

1.04 SUBMITTALS:

A. Product Data:

1. For information only, submit four (4) copies of manufacturer's technical data and installation instructions for each toilet accessory. Transmit copies of installation instructions to the Installer.

B. Samples:

1. When requested, submit full-size samples of units to Architect for review of design and operation. Acceptable samples will be returned and may be used in the work. Compliance with all other requirements is the exclusive responsibility of the Contractor.

C. Setting Drawings:

1. Provide setting drawings, templates, instructions and directions for installation of anchorage devices in other work.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Stainless Steel: AISI, Type 302/304 with polished No. 4 finish, 0.034 inch (22 gauge) minimum thickness.
- B. Brass: Unleaded , flat products, ASTM B19; rods, shapes, forgings, and flat products with finished edges, ASTM B16; castings, ASTM B30.
- C. Sheet Steel: Cold rolled, commercial quality, ASTM A336, 0.04 inch (20 gauge) minimum. Surface preparation and metal pretreatment as required for applied finish.
- D. Galvanized Steel Sheet: ASTM A527, G60.
- E. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B456, Type SC2.
- F. Mirror Glass: Nominal 6.0mm (0.23 inch) thick, conforming to ASTM C1036, Type I, Class 1, Quality q2, and with silvering electro-plated copper coating, and protective organic coating.
 - 1. Provide tempered glass, unless indicated otherwise.
- G. Galvanized Steel Mounting Devices: ASTM A153, hot-dip galvanized after fabrication.
- H. Fasteners: Screws, bolts, and other devices of same material as accessory unit, or of galvanized steel where concealed.
- I. Refer to plans for locations and quantities of all toilet accessories.

2.02 MIRRORS

- A. Stainless Steel Framed Mirror: Mirror shall have a one piece, Type 304 stainless steel angle frame, 3/4 inch by 3/4 inch with continuous integral stiffener on all sides and beveled front to hold frame tightly against mirror; corners shall be heliarc welded, ground and polished smooth; all exposed surfaces shall have satin finish with vertical grain. Tempered glass mirror shall be guaranteed for 15 years against silver spoilage. All edges shall be protected by plastic filler strips and the back shall be protected by full size, shock absorbing, water resistant, nonabrasive, 1/8 inch thick polyethylene padding.

Galvanized steel back shall have integral hanging brackets for mounting on concealed rectangular wall hanger(s).

Mirror shall be secured to hanger(s) with concealed phillips head jocking screws located in bottom of frame.

1. Manufacturers: Subject to compliance with requirements, provide mirror unit by one of the following:
 - a. Bobrick: B-290. Provide with tempered glass.
2. Mount bottom edge of glass at 40'' max. AFF.

2.03 GRAB BARS

- A. Stainless Steel Type: Provide grab bars with wall thickness not less than 0.05 inch and as follows:
 1. Mounting: Concealed, manufacturer's standard flanges and anchorages.
 2. Clearance: 1-1/2 inch clearance between wall surface and inside face of bar.
 3. Gripping Surfaces
 - a. Satin finish with peened gripping surface, unless noted otherwise.
 4. Heavy Duty Size: Outside diameter of 1-1/2 inches minimum.
- B. Grab bar shall be constructed of Type 304 stainless steel with satin finish. Concealed mounting flanges shall be 1/8 inch thick stainless steel plate, 3-1/8 inch diameter, and each shall have 2 screw holes for attachment to wall. Flange covers shall be 22 gauge, 3-1/4 inch diameter by 1/2 inch deep, and shall snap over mounting flange to conceal mounting screws. Ends of grab bars shall pass through concealed mounting flanges and be heliarc welded to form one structural unit. Grab bars shall comply with ADA Accessibility Guidelines for structural strength. Provide concealed anchor device or backing as specified or required in accordance with local building codes before wall is finished.
 1. Manufacturers: Subject to compliance with requirements, provide grab bars by one of the following:
 - a. Bobrick: B-6806.99 Series
 1. Horizontal: B-6806.99 by 36''
 2. Horizontal: B-6806.99 by 42''
 3. Vertical: B-6806.99 by 18''
 2. Mount center of grab bar at xx max AFF.

2.04 ELECTRIC HAND DRYER

- A. Wall mounted, vandal resistant, Electric hand Dryer, 10 seconds dry time (adjustable sound and speed), 100-240V, 50/60Hz.
 - 1. Extreme Air Model GXT9, White ABS.
 - 2. Mount unit with air outlet or control knob 48'' max. AFF.

2.05 MISCELLANEOUS ACCESSORIES

- A. Mop and Broom Holders (MH): Surface mounted mop and broom holder shall be Type 304 stainless steel with satin finish. Unit shall be 36 inches long with 4 spring loaded, rubber cam holders. Manufacturers: Subject to compliance with requirements, provide accessories by one of the following:
 - a. Bobrick: B-223-36
 - b. Mount on wall in each Janitor Closet near slop sink.

B. Trapwrap

- 1. Provide trapwrap under all wall mounted lavatories to conceal all exposed waste and supply piping.
- 2. Trapwrap to be as manufactured by Brocar Products Inc. or TrueBro.

C. Fasteners and Anchors

- 1. Provide mounting kits with stainless steel screws for accessories requiring same.
- 2. Mounting kits shall include toggle nuts for hollow walls and expansion shields for solid walls. Provide 2 fasteners at each mounting plate.
- 3. Provide 12 gauge, 3 inches wide, steel concealed anchor plates with tapped holes for installation of grab bars on walls constructed with metal studs.
- 4. Provide concealed anchors for installation of grab bars on solid walls. Anchor assembly shall consist of tapped 12 gauge anchor plate, 10 gauge back plate, and 3/8 inch diameter thru-wall bolt.

2.06 SOAP DISPENSER

- A. Wall mounted, foaming hand soap dispenser, black plastic encased, 1000 ml capacity.
 - 1. Manufacturers: Subject to compliance with requirements, provide unit by one of the following:
 - a. Spartan ``Lite'n Foamy'' model 975700.
 - b. Mount unit on wall at 48'' max. AFF to dispensing point or control knob for ADA ht.

2.07 SANITARY NAPKIN DISPOSAL

- A. Stainless Steel, Satin Finish, Sanitary Napkin Disposal unit, self closing panel, removable, leakproof, mounted in wall of toilet partition (with access from toilet stall on each side of this unit).
 - 1. Manufacturers: Subject to compliance with requirements, provide unit by one of the following:
 - a. Bobrick: B-354.
 - b. Mount unit at 30'' max. to top of unit for ADA ht.

2.08 TOILET TISSUE DISPENSER

- A. Stainless Steel, satin finish, surface mounted twin jumbo roll, with tumbler lock and sliding access panel.
 - 1. Manufacturers: Subject to compliance with requirements, provide unit by one of the following:
 - a. Bobrick: B-2892.
 - b. Mount unit at 30'' to top max. for ADA ht.

2.09 TOWEL DISPENSER/DISPOSAL

- A. Stainless Steel, satin finish, semi-recessed, Paper Towel Dispenser/Disposal unit, dispenses 600 C-fold towels with removable and leakproof 6.3 gal. waste container, and locks.
 - 1. Manufacturers: Subject to compliance with requirements, provide unit by one of the following:
 - a. Bobrick: B-38032.
 - b. Mount unit with towel dispensing slot at 48'' AFF max.

2.10 BABY CHANGING STATION

- A. Horizontal, plastic, wall mounted unit with fold down table, cream color, 35''Wx22''Hx4''D.
 - 1. Manufacturers: Subject to compliance with requirements, provide unit by one of the following:
 - a. Bobrick: KB-200-00.
 - b. Mount unit as instructed by Manuf. to meet ADA ht. requirements.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Installer must examine the areas and conditions under which toilet accessories are to be installed and notify the General Contractor in writing, of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 INSTALLATION:

- A. Use concealed fastenings wherever possible.
- B. Provide anchors, bolts and other necessary anchorages and attach accessories securely to walls and partitions in locations as shown or directed.
- C. Install concealed mounting devices and fasteners fabricated of the same materials as the accessories, or of galvanized steel, as recommended by manufacturer.
- D. Install exposed mounting devices and fasteners finished to match the accessories.
- E. Provide theft-resistant fasteners for all accessory mountings.
- F. Secure toilet room accessories in accordance with the manufacturer's instructions for each item and each type of substrate construction.

END OF SECTION 10800

SECTION 10999 - MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section, and Division 16 (wiring of fluorescent lighting).

1.02 DESCRIPTION OF WORK:

- A. The extent of miscellaneous specialties is as shown on the drawings or schedules and includes the following:

- 1. Dedicatory plaque
- 2. Exterior Benches
- 3. Cupola
- 4. Bike Rack
- 5. ADA Picnic Table
- 6. Electric Fireplace
- 7. Pergola
- 8. Pavilion
- 9. Pull Down Stairs
- 10. Private Vanity
- 11. Shower Enclosure and Base
- 12. Exterior Digital Sign

1.03 SUBMITTALS:

- A. Product Data:

- 1. Submit two (2) copies of manufacturer's specifications and installation instructions for each type of specialty required. Indicate by transmittal that copy of each instruction has been distributed to the Installer.

- B. Samples:

- 1. Submit three (3) samples of each color and finish of exposed materials and accessories required for each specialty. Architect's review of samples will be for color and texture only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

- C. Shop Drawings:

1. Submit shop drawings for fabrication and erection of specialties, including plans, elevations and large scale details, shop anchorages and accessory items. Provide location template drawings for items supported or anchored to permanent construction.

PART 2 - PRODUCTS

2.01 PREFABRICATED PRODUCTS:

A. Dedicatory Plaque

1. Provide 24'' x 36'' cast aluminum plaque with leatherette textured oxidized background with polished letters. Plaque shall be bevel edge and shall have thereon the following:
 - DDA Board members and titles
 - Mayor/Supervisor, Architect, General Contractor and Titles
 - Date
 - Building Name
 - Name of Township

B. Exterior Benches

1. Provide concrete bench WS-136 from the Wausau Select Line as manufactured by Wausau Tile, Wausau, WI 1-800-388-8728.
 - a. Bench shall be 72"w x 18"d x 16"h, 405 lbs.
 - b. Color as selected from manufacturer's standard 10 colors.
 - c. Quantity: Provide eleven (11) benches in locations shown on site plan.

C. Cupola

1. Provide one (1) prefabricated Cupola. Style to be "The Concord Cupola", 48" sq x 64"h, white vinyl with metal roof. Roof color to be selected.
www.ecoastweathervanes.com.

D. Bike Rack

1. Provide one (1) surface mounted bike rack, "The Wave Bike rack" 7 Curve Style, as manufactured by Bike rack Mfg. and Dist. Co., (416)927-7499,

www.bikerack.ca

2. Provide powder coat finish, color TBD from manuf. standard colors.

E. ADA Picnic Table

1. Provide ADA Recycled Plastic Table, hexagon shape, model WBB734568, as manufactured by Global Industrial, 888-978-7759, globalindustrial.com.
 - a. Table shall be 78 1/2"w x 78 1/2"d x 30 1/2"h, 205 lbs., Surface Mount style.
 - b. Top Color: Cedar, frame Color: Black.
 - c. Quantity: Provide two (2) benches in locations shown on site plan.

F. Electric Fireplace

1. Provide Electric Fireplace, Model No. ZCR-3824, Insert Style, as manufactured by Modern Flames, 877-246-9353, www.modernflames.com.
2. Provide perimeter trim kit and all accessories as required for a complete installation.

G. Pergola Kit

1. Provide 20'x20' Freestanding Structural Fiberglass Pergola Kit as manuf. by Pergola Kits USA, Levittown, NY, 800-403-9259, www.pergolakitsusa.com.
 - a. Pergola shall have 10"x8' tapered column
 - b. Semi-custom color to be selected by owner.
 - c. Rafter Tail design to be Kensington.

H. Pavilion

1. Provide 14'x20' Premium Vinyl Pavilion Kit as manuf. by Pergola Kits USA, Levittown, NY, 800-403-9259, www.pergolakitsusa.com.
 - a. Pavilion shall have 8' tall columns.
 - b. Semi-custom color to be selected by owner.
 - c. Metal roof, 8:12 slope, color to be selected by owner.

I. Pull Down Stairs

1. Provide Pull Down Stair system, 63 1/4"L x 29 1/2"d, Super Simplex Disappearing Stairway with Standard Box Frame, as manuf. by Precision ladders, LLC, Morristown, TN, 423-586-2265,

www.precisionladders.com.

a. Stair to have load rating of 500 lbs.

J. Private Vanity (Room A108)

1. Provide private pre-fabricated vanity, model K-99526-TK as manuf. by Kohler, 800-456-4537, www.kohler.com.
 - a. Provide Vanity Top K-5455 and Knob K-99686.

K. Shower Enclosure and Base (Room A108)

1. Provide 36" Frameless Corner Shower Enclosure, Delta Model No. BS12912-3636-SS, brushed stainless steel with clear glass.
2. Provide 36" Corner Shower Base, Delta Model No. B710912-3636-WH, white color.

L. Exterior Digital Sign

1. Provide one (1) exterior, double-sided, full color LED display digital sign, in locations shown, as manufactured by Electro-Matic, Farmington, Mi., Contact: Derek Klanke, 248-417-0215, drkklanke@electromatic.com. (or approved equal)
2. Sign display dimensions to be 3'-3.37"H x 5'-2.99"W, 17.22sf.
3. Sign cabinet dimensions to be 3'-7.19"H x 5'-6.12"W, 19.82sf.
4. Sign voltage to be 120V.
5. Include all operating software and communication accessories as required for a complete system.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Installer must examine the substrates and conditions under which the specialties are to be installed, and notify the General Contractor and Architect in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 INSTALLATION:

- A. In addition to the requirements of these specifications, comply with manufacturer's instructions and recommendations for preparation of substrate, installation of anchors, and application of specialties. Coordinate

with work of other trades for application of inserts of other integral equipment items.

- B. Install at the locations shown or scheduled, securely mounted with concealed fasteners, unless otherwise shown. Attach to substrates in accordance with the manufacturer's instructions, unless otherwise shown.
- C. Install level, plumb and at the proper height. Cooperate with other trades for installation in finish surface. Repair or replace damaged units as directed by the Architect.

END OF SECTION 10999

SECTION 20 0010
BASIC MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 APPLICATION

- A. This section applies to all mechanical work. The contractors involved shall check all sections of the specifications in addition to the particular section covering their specific trade. Each distinct section of the specifications aimed for one trade may have detailed information with regards to other trades, therefore, it is imperative that all sections be reviewed to get a complete picture of all other trades' functions and work required
- B. The mechanical contractor is responsible for the installation and operation of the plumbing, hvac systems, and temperature control systems.
- C. The mechanical contractor is responsible for receiving, unloading and placement of all of the owner provided equipment.

1.03 DRAWINGS

- A. The drawings are diagrammatic and show general location and arrangement of all the equipment and piping.
- B. Do not scale drawings for measurements.
- C. Field verifications of actual existing conditions are required by the contractor since actual locations, distances, and levels will be governed by actual field conditions. All measurements shall be verified at the site.
- D. Examine the drawings of other trades and verify the conditions governing the work on the job site. Arrange work accordingly, providing such fittings, traps, valves and accessories as may be required to meet such conditions.
- E. If during field verification, the contractor identifies that there may require substantial changes from the original plans, the contractor shall notify the architect for agreement on necessary adjustment before the installation is started
- F. Discrepancies shown between plans, or between plans and actual field conditions, or between plans and specifications shall promptly be brought to the attention of the architect for a decision.
- G. Drawings and specifications are intended to cover the completed installation of systems to function as described. The omission of the expressed reference to any item of labor and material necessary to comply with practice codes, ordinances, etc., shall not relieve the contractor from providing such additional labor and material at no cost to Owner.
- H. The drawings show the location and general arrangement of equipment, piping and related items. They shall be followed as closely as elements of the construction will permit.
- I. Deviations from the drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect.
- J. The architectural and structural drawings take precedence in all matters pertaining to the building structure, mechanical drawings in all matters pertaining to mechanical trades and electrical drawings in all matters pertaining to electrical trades. Where there are conflicts or differences between the drawings for the various trades, report such conflicts or differences to the Architect for resolution.

1.04 PERMITS

- A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for mechanical work shall be secured and paid for by the contractor. All work shall conform to all applicable codes, rules and regulations.

1.05 CODES

- A. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed drawings or diagrams, which may be required by the governing authorities. Where the drawings and/or specifications indicate materials for construction in excess of code requirements, the drawings and/or specifications shall govern.
 - 1. Michigan Mechanical Code, 2015.
 - 2. Michigan Plumbing Code, 2015.

1.06 MAINTENANCE

- A. Provide 40 hours of instruction to the owner's designated personnel in the maintenance and operation of equipment and systems.
- B. Provide complete maintenance and operating instructional manuals covering all mechanical equipment herein specified, together with parts lists. Maintenance and operating instructional manuals shall be job specific to this project. Generic manuals are not acceptable. Four (4) copies of all literature shall be furnished for owner and shall be bound in book or ring binder form. Maintenance and operating instructional manuals shall be provided when construction is approximately 75% complete.

1.07 WARRANTY AND GUARANTEE

- A. Contractor shall guarantee all work installed by him or his subcontractors to be free from defect in material and workmanship for a period of one year from date of final acceptance of the work, unless a longer period is stipulated under specific headings. Contractor shall repair or replace at no additional cost to the owner, any material or equipment developing defects and shall also make good any damage caused by such defects or the correction of defects. Repairs or replacements shall bear additional guarantee, as originally called for, dated from the final acceptance of the repair or replacement. This requirement shall be binding even though it will exceed product guarantees normally furnished by some manufacturers. Contractor shall submit his own and each equipment manufacturers written certificates, warranting that each item of equipment furnished complies with all requirements of the drawings and specifications. Note that guarantee shall run from date of final acceptance of the work, not from date of installation of a device or piece of equipment.

1.08 SUBMITTALS

- A. Types of submittals include the following:
 - 1. Shop Drawings
 - 2. Product Data Sheets
 - 3. Samples
 - 4. Manufacturers Instructions
 - 5. Maintenance Data
 - 6. Warranty
- B. Installation of any item that requires submittal approval by the engineer shall be installed at the contractors risk. The contractor, at his cost, shall remove all work installed prior to approval of the submittal.
- C. The engineer will not be responsible for errors in quantities, or dimensions required to fit the job condition, details of fabrication to insure proper assembly at the job, or for errors resulting from mistakes in submittals.

- D. For underground piping, record dimensions and invert elevations of all piping, including all offsets, fittings, cathodic protection and accessories. Locate dimensions from benchmarks that will be preserved after construction is complete.
- E. Product data cut sheets shall be submitted on the material and equipment as requested in these specifications.

1.09 RECORD DRAWINGS

- A. Record drawings shall be maintained by the contractor up to date as the project progresses.
- B. Recording all deviations from the contract documents, indicate exact locations of all buried services both inside and outside of the building; include concealed piping and equipment in the entire contract. Final record drawings shall reflect the as-built conditions.

1.10 QUALITY ASSURANCE

- A. Other referenced standards:
 - 1. Comply with referenced standards, guidelines, data sheets from various associations, including NFPA, ANSI, ASTM, ASME, ASHRAE

PART 2 PRODUCTS

2.01 SLEEVES AND ESCUTCHEONS

- A. Provide sleeves wherever pipes pass through exterior wall, and floors. Sleeves shall be schedule 40 steel pipe cut to length. Sleeves shall terminate flush with walls, partitions and ceilings in finished areas. All sleeves through floor shall extend 2" above floor. Provide cast brass nickel-plated escutcheons with positive catches on each visible sleeve penetration. Sleeves are to be sealed at each installation with a 3M approved sealant. The space between the inside of the sleeve and the outside of the pipe or conduit within the sleeve shall be sealed at each installation with a 3M approved sealant.

2.02 DIELECTRIC UNIONS

- A. Dielectric unions shall be used to connect dissimilar metals (such as steel and copper) to prevent electrolytic action.

2.03 FILTERS

- A. Provide and maintain filters in air handling systems throughout the construction period and prior to final acceptance of the building. Do not run air handling equipment without all prefilters and final filters as specified. Immediately prior to final building acceptance by the owner, contractor shall replace all disposable type air filters with new.

2.04 BUILDING ATTACHMENTS FOR MECHANICAL WORK SUPPORTS

- A. General Requirements:
 - 1. Provide building attachments required for supporting mechanical work, suitably selected and installed for the loads applied with a minimum additional safety factor of 3.
 - 2. Where specified attachments are not suitable for conditions, submit to Engineer for approval, proposal for alternate building attachments.
 - 3. Approved Manufacturers: Grinnell, or equivalent products by Michigan Hanger and B-Line.
 - 4. Provide supplemental trapeze supports where necessary. Design trapeze to support all trades. Coordinate loads, and supports with all trades. Size trapeze for maximum deflection of 1/64 of the span.
- B. Attachments to Structural Steel:
 - 1. Support mechanical work from building structural steel where possible and approved. No welding or bolting to structural steel is permitted unless authorized by Architect. C-clamps are not permitted.
 - a. Center beam clamp - for loads over 120 lb.: Malleable center hung Grinnell Fig. 228.
 - b. Side beam clamp with retaining clips - for loads up to 120 lb.
- C. Cast in Place Concrete Inserts:

1. Provide inserts selected for applied load of present load plus 100% for future, and coordinated with concrete work. Except as detailed on drawings, inserts shall be Unistrut or Grinnell. Plan, lay out and coordinate setting of inserts prior to concrete pour. Use Grinnell Fig. 285 lightweight concrete insert for loads up to 400# or Grinnell Fig. 281 Wedge Type concrete insert for loads up to 1200#
- D. Drilled Insert Anchors:
 1. Where mechanical work cannot be supported from structural steel, or cast in place concrete inserts, provide drilled concrete insert anchors. Submit for approval, project specific installation drawings for all loads over 100 lbs. Install inserts in web of beam if possible and approved. Insert depth shall not exceed two thirds the thickness of the concrete. Where existing concrete appears to be deteriorating, or where applied load at insert exceeds 1000 lbs., conduct test of concrete to determine derated capacity of insert. Anchors may be adhesive or expansion type up to 1000 lbs., and shall be adhesive type for loads over 1000 lbs.
 2. Manufacturers: Hilti

PART 3 EXECUTION

3.01 GENERAL

- A. Arrange work accordingly, providing such fittings as duct transitions traps, valves and accessories necessary to complete all construction in an orderly fashion.
- B. Install all equipment in strict accordance all directions and recommendations furnished by the manufacturer.

3.02 ACCESSIBILITY

- A. Do not locate traps, controls, unions, pull boxes, etc. in any system at a location that will be inaccessible after construction is completed. Maintain accessibility for all components in mechanical, electrical, and plumbing systems.

3.03 ACCESS PANELS:

- A. Furnish access panels to access valves, traps, control valves or devices, dampers, damper motors, etc. Access panels shall be sized as necessary for ample access, or as indicated on drawings, but no smaller than 12" x 12" where devices are within easy reach of operator, and at least 24"x24" when operator must pass through opening in order to reach the devices. Architectural Trades shall install access panels coordinated with Mechanical Trades.
- B. Access panels in fire rated walls or ceiling must be U.L. labeled for intended use. Unless otherwise indicated on plans, access doors shall be hinged flush type steel framed panel, 14 gauge minimum for frame, and with anchor straps. Only narrow border shall be exposed. Hinges shall be concealed type. Locking device shall be flush type and screw driver operated. Metal surfaces shall be prime coated with rust-inhibitive paint. Panels shall be compatible with architectural adjacent materials Manufacturer: Milcor, Bilco.
- C. Coordinate location with architect prior to installation.

3.04 CUTTING AND PATCHING

- A. All cutting required shall be done by the contractor whose work is involved, without extra cost the owner. All patching and restoration including the furnishing and installation of access panels in ceiling, walls; etc. Within the building lines shall be done by the respective, responsible contractor. No cutting of structural steel, concrete, or wood shall be done without prior approval and explicit directions of the architect patched by the respective, responsible contractor.
- B. The contractor, under whose jurisdiction the work may fall, shall provide labor, material, and tools required to cut, repair, protect, cap, or relocate existing pipes, conduits, or utilities interfering with or uncovered during work, per regulations of the authorities having jurisdiction.

3.05 ROUGH-IN FOR CONNECTION TO EQUIPMENT

- A. It shall be the responsibility of each contractor to study the architectural, structural, electrical, and mechanical drawings, conferring with the various trades involved and checking with the supplier of equipment in order to properly rough-in for all equipment.

3.06 MATERIAL AND EQUIPMENT

- A. All material and equipment shall be new and of the best quality used for the purpose in good commercial practice, and shall be the standard product of reputable manufacturers. The material and equipment must meet approval of state and local codes in the area it is being used. Roof decks shall not be used to support piping, conduit, equipment, devices, etc.

3.07 SEAL PENETRATIONS

- A. Seal the space around pipes in sleeves and around duct openings through walls, floors and ceilings. Provide adequate clearance to allow for proper sealing.

3.08 FIRE STOPPING

- A. Provide UL classified firestopping system for mechanical penetrations through rated walls and floors to maintain the fire rating.

3.09 CONTROL WIRING

- A. All control wiring for mechanical and electrical equipment, including motor starters, shall be 120 volt maximum and wired with one side of the coil grounded and the operating contacts in the north side of the circuit. All control wiring shall be installed in conduit.

END OF SECTION

SECTION 20 0020
ELECTRICAL REQUIREMENTS FOR MECHANICAL WORK

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

- A. Basic electrical requirements for mechanical work.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Mechanical equipment is to be furnished with motors, electrical controls and protective devices, and integral operating devices which are normally included by the manufacturer or required by the Contract Documents.
- B. The Mechanical Trades shall provide all control wiring, 120 volts and less, for the equipment and devices furnished under Division 21, 22, and 23 of these specifications, including all wiring devices, conduit, etc.
- C. Power wiring 120 volts and greater shall be by the Electrical Trades.

2.02 QUALITY ASSURANCE

- A. All electrical devices provided by Mechanical Trades, and all electrical devices furnished as part of the mechanical equipment shall be Underwriters Laboratories (UL) listed.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 22 0519
METERS AND GAGES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flow meters.
- B. Pressure gages and pressure gage taps.
- C. Thermometers and thermometer wells.

1.02 REFERENCE STANDARDS

- A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2013.
- B. ASME MFC-3M - Measurement of Fluid Flow in Pipes Using Orifice, Nozzle and Venturi; 2007.
- C. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014.
- D. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014.
- E. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

1.04 FIELD CONDITIONS

- A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.01 LIQUID FLOW METERS

- A. Manufacturers:
 - 1. Dwyer Instruments, Inc: www.dwyer-inst.com.
 - 2. Venture Measurement, a Danaher Corporation Company: www.venturemeasurement.com.
 - 3. McCrometer, Inc: www.mccrometer.com.
- B. Calibrated ASME MFC-3M venturi orifice plate and flanges with valved taps, chart for conversion of differential pressure readings to flow rate, with pressure gage in case.
- C. Annular element flow stations with meter set.
 - 1. Measuring Station: Type 316 stainless steel pitot type flow element inserted through welded threaded couplet, with safety shut-off valves and quick coupling connections, and permanent metal tag indicating design flow rate, reading for design flow rate, metered fluid, line size, station or location number.
 - a. Pressure rating: 275 psi.
 - b. Maximum temperature: 400 degrees F.
 - c. Accuracy: Plus 0.55 percent to minus 2.30 percent.

2.02 PRESSURE GAGES

- A. Manufacturers:
 - 1. Dwyer Instruments, Inc: www.dwyer-inst.com.
 - 2. Moeller Instrument Company, Inc: www.moellerinstrument.com.
 - 3. Omega Engineering, Inc: www.omega.com.
- B. Pressure Gages: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
 - 1. Case: Steel with brass bourdon tube.

2. Size: 4-1/2 inch diameter.
3. Mid-Scale Accuracy: One percent.
4. Scale: Psi and kPa.

2.03 STEM TYPE THERMOMETERS

- A. Manufacturers:
 1. Dwyer Instruments, Inc: www.dwyer-inst.com.
 2. Omega Engineering, Inc: www.omega.com.
 3. Weksler Glass Thermometer Corp: www.wekslerglass.com.
- B. Thermometers - Fixed Mounting: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish.
 1. Size: 9 inch scale.
 2. Window: Clear Lexan.
 3. Accuracy: 2 percent, per ASTM E77.
 4. Calibration: Degrees F.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide one pressure gage per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gage.
- C. Install pressure gages with pulsation dampers. Provide gage cock to isolate each gage. Extend nipples and siphons to allow clearance from insulation.
- D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

END OF SECTION

SECTION 22 0553
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007 (ANSI/ASME A13.1).

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Brady Corp.
- B. Champion-America, Inc.
- C. Seton Identification Products.

2.02 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters.
 - 1. Letter Color: White.
 - 2. Letter Height: 1/4 inch.
 - 3. Background Color: Black.

2.03 TAGS

- A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
- B. Chart: Typewritten letter size list in anodized aluminum frame.

2.04 PIPE MARKERS

- A. Comply with ASME A13.1.
- B. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

PART 3 EXECUTION

3.01 PREPARATION

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

3.02 INSTALLATION

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- E. Identify piping, concealed or exposed, with plastic tape pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs

including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

- F. Install ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

3.03 SCHEDULES

- A. Identify all mechanical equipment, piping, and ductwork with nameplates, tags and markers.

END OF SECTION

**SECTION 22 0719
PLUMBING PIPING INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping insulation.
- B. Jackets and accessories.

1.02 REFERENCE STANDARDS

- A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.
- B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).
- C. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2015.
- D. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013).
- E. ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber; 2014.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.
- H. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.
- I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER

- A. Manufacturers:
 - 1. Knauf Insulation: www.knaufusa.com.
 - 2. Johns Manville Corporation: www.jm.com.
 - 3. Owens Corning Corp: www.owenscorning.com.
- B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
 - 1. 'K' Value: ASTM C177, 0.24 at 75 degrees F.
 - 2. Maximum Service Temperature: 850 degrees F.
 - 3. Maximum Moisture Absorption: 0.2 percent by volume.
 - 4. Density: 3.5 lb/cu. ft
- C. Vapor Barrier Jacket:
 - 1. White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E 96 of 0.02 perm-inches.
- D. Tie Wire:
 - 1. 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

- E. Vapor Barrier Lap Adhesive: Compatible with insulation.
 - 1. Vapor Barrier Lap Adhesive shall be compatible with the insulation and as recommended by the insulation manufacturer
- F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
 - 1. ASTM C195; hydraulic setting on mineral wool.
- G. Fibrous Glass Fabric:
 - 1. Cloth: Untreated; 9 oz/sq yd weight.
 - 2. Blanket: 1.0 lb/cu ft density.
 - 3. Weave: 5x5.
- H. Indoor Vapor Barrier Finish:
 - 1. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.03 JACKETS

- A. PVC Plastic.
 - 1. Manufacturers:
 - a. Johns Manville Corporation: www.jm.com.
 - b. Protto
 - c. Ceelco
 - 2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: 0 degrees F.
 - b. Maximum Service Temperature: 150 degrees F.
 - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
 - d. Thickness: 10 mil.
 - e. Connections: Brush on welding adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Glass fiber insulated pipes conveying fluids below ambient temperature:
 - 1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- E. Glass fiber insulated pipes conveying fluids above ambient temperature:
 - 1. Provide standard jackets, with vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- F. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.

3.03 SCHEDULES

- A. Plumbing Systems:
 - 1. Domestic Hot Water Supply and Return
 - a. Glass Fiber Insulation:
 - 1) Pipe Size Range: 1/2-3 inch.
 - 2) Thickness: 1 inch.
 - 2. Domestic Potable and non Potable Cold Water:
 - a. Glass Fiber Insulation:
 - 1) Pipe Size Range: 3 inch.
 - (a) Thickness: 1 inch.

END OF SECTION

**SECTION 22 1005
PLUMBING PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe, pipe fittings, valves, and connections for piping systems.
 - 1. Sanitary sewer.
 - 2. Domestic water.
 - 3. Natural Gas.
 - 4. Pipe hangers and supports.
 - 5. Valves.
 - 6. Flow controls.
 - 7. Check.
 - 8. Strainers.

1.02 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
- C. Welder Certificate: Include welders certification of compliance with ASME BPVC-IX.

1.03 QUALITY ASSURANCE

- A. Perform Work in accordance with State of Michigan standards.
- B. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.
- C. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

1.04 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with State of Michigan plumbing code.
- B. Conform to applicable code for installation of backflow prevention devices.
- C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.06 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Pipe: CISPI 301 (latest edition) bearing collective trademark of CISPI, hubless.
 - 1. Fittings: Cast iron.

2. Joints: CISPI 310 (latest edition) bearing the markings of NSF International, neoprene gasket and stainless steel clamp and shield assemblies.
- B. PVC Pipe: ASTM D2665 or ASTM D3034.
1. Fittings: PVC.
 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.03 SANITARY SEWER AND VENT PIPING, ABOVE GRADE

- A. Cast Iron Pipe: CISPI 301 (latest edition) bearing collective trademark of CISPI, hubless, service weight.
1. Fittings: Cast iron.
 2. Joints: CISPI 310 (latest edition) bearing the markings of NSF International, neoprene gaskets and stainless steel clamp-and-shield assemblies.
- B. Steel Pipe: ASTM A53/A53M Schedule 40, galvanized, using one of the following joint types:
1. Threaded Joints: ASME B16.4 cast iron fittings.
 2. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

2.04 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), Drawn (H).
1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 2. Joints: ASTM B32, alloy Sn95 solder.

2.05 NATURAL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
 2. Joints: Threaded or welded to ASME B31.1.

2.06 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
 3. Trapeze Hangers: Welded steel channel frames attached to structure.
 4. Vertical Pipe Support: Steel riser clamp.
- B. Plumbing Piping - Drain, Waste, and Vent:
1. Conform to ASME B31.9.
 2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
 3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
 4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
 6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
 7. Vertical Support: Steel riser clamp.
 8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- C. Plumbing Piping - Water:
1. Conform to ASME B31.9.
 2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
 3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

4. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.
5. Hangers for Hot Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron pipe roll, double hanger.
6. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded supports or spacers and hanger rods, cast iron roll.
8. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
9. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
10. Wall Support for Hot Pipe Sizes 6 Inches and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron pipe roll.
11. Vertical Support: Steel riser clamp.
12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
14. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron pipe roll and stand, steel screws, and concrete pier or steel support.
15. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.07 GLOBE VALVES

- A. Manufacturers:
 1. Tyco Flow Control: www.tycoflowcontrol.com.
 2. Conbraco Industries, Inc: www.apollovalves.com.
 3. Nibco, Inc: www.nibco.com.
 4. Milwaukee Valve Company: www.milwaukeevalve.com.
- B. Up To and Including 3 Inches:
 1. 1, Class 125, bronze body, bronze trim, handwheel, bronze disc, solder ends.
- C. 2 Inches and Larger:
 1. 1, Class 125, iron body, bronze trim, handwheel, outside screw and yoke, renewable bronze plug-type disc, renewable seat, flanged ends. Provide chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.08 BALL VALVES

- A. Manufacturers:
 1. Tyco Flow Control: www.tycoflowcontrol.com.
 2. Conbraco Industries, Inc: www.apollovalves.com.
 3. Nibco, Inc: www.nibco.com.
 4. Milwaukee Valve Company: www.milwaukeevalve.com.
- B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder ends with union.

2.09 FLOW CONTROLS

- A. Manufacturers:
 1. Tyco Flow Control: www.tycoflowcontrol.com.
 2. ITT Bell & Gossett: www.bellgossett.com.
 3. Griswold Controls: www.griswoldcontrols.com.
 4. Taco, Inc: www.taco-hvac.com.
- B. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.

- C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

2.10 SWING CHECK VALVES

- A. Manufacturers:
 - 1. Tyco Flow Control: www.tycoflowcontrol.com.
 - 2. Hammond Valve: www.hammondvalve.com.
 - 3. Nibco, Inc: www.nibco.com.
 - 4. Milwaukee Valve Company: www.milwaukeevalve.com.
- B. Up to 2 Inches:
 - 1. 1, Class 125, bronze body and cap, bronze swing disc with rubber seat, solder ends.
- C. Over 2 Inches:
 - 1. 1, Class 125, iron body, bronze swing disc, renewable disc seal and seat, flanged or grooved ends.

2.11 STRAINERS

2.12 STRAINERS

- A. Manufacturers:
 - 1. Mueller Steam Specialties
 - 2. Nibco, Inc.
 - 3. Watts Water Technologies
 - 4. Zurn Industries, LLC.
- B. Size 2 inch and Under:
 - 1. Class 150, lead free, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
- C. Size 1-1/2 inch to 4 inch:
 - 1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions. Cast iron soil pipe installed in accordance to CISPI's Handbook.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- G. Provide access where valves and fittings are not exposed.
- H. Establish elevations of buried piping outside the building to ensure not less than 4 ft of cover.

- I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- J. Provide support for utility meters in accordance with requirements of utility companies.
- K. Install valves with stems upright or horizontal, not inverted.
- L. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.
- M. PVC Pipe: Underground installation in compliance to ASTM D-2321. Make solvent-welded joints in accordance with ASTM D2855.
- N. Sleeve pipes passing through partitions, walls and floors.
- O. Inserts:
 - 1. Provide inserts for placement in concrete formwork.
 - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
 - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- P. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9.
 - 2. Support horizontal piping as scheduled.
 - 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 - 4. Place hangers within 12 inches of each horizontal elbow.
 - 5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 - 7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 - 8. Provide copper plated hangers and supports for copper piping.
 - 9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
 - 10. Support cast iron drainage piping at every joint.

3.04 APPLICATION

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- C. Install gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- D. Install globe valves for throttling, bypass, or manual flow control services.
- E. Provide flow controls in water recirculating systems where indicated.

3.05 TOLERANCES

- A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/8 inch per foot slope.
- B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfect water distribution system in accordance with Section 33 1300.

- B. Prior to starting work, verify system is complete, flushed and clean.
- C. Ensure Ph of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- D. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
- E. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- F. Maintain disinfectant in system for 24 hours.
- G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- H. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- I. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.07 SCHEDULES

- A. Pipe Hanger Spacing:
 - 1. Metal Piping:
 - a. Pipe size: 1/2 inches to 1-1/4 inches:
 - 1) Maximum hanger spacing: 6.5 ft.
 - 2) Hanger rod diameter: 3/8 inches.
 - b. Pipe size: 1-1/2 inches to 2 inches:
 - 1) Maximum hanger spacing: 10 ft.
 - 2) Hanger rod diameter: 3/8 inch.
 - c. Pipe size: 2-1/2 inches to 3 inches:
 - 1) Maximum hanger spacing: 10 ft.
 - d. Pipe size: 4 inches to 6 inches:
 - 1) Maximum hanger spacing: 10 ft.
 - 2) Hanger rod diameter: 5/8 inch.
 - 2. Plastic Piping:
 - a. All Sizes:
 - 1) Maximum hanger spacing: 6 ft.
 - 2) Hanger rod diameter: 3/8 inch.

END OF SECTION

**SECTION 22 1006
PLUMBING PIPING SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Drains.
- B. Floor drains.
- C. Cleanouts.
- D. Hydrants.
- E. Backflow preventers.
- F. Water hammer arrestors.
- G. Mixing valves.

1.02 RELATED REQUIREMENTS

- A. Section 22 1005 - Plumbing Piping.
- B. Section 22 4000 - Plumbing Fixtures.
- C. Section 22 3000 - Plumbing Equipment.

1.03 REFERENCE STANDARDS

- A. ASME A112.6.3 - Floor and Trench Drains; 2001 (R2007).
- B. ASSE 1013 - Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers; 2011.
- C. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2011.
- D. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).
- E. NSF 372 - Drinking Water System Components - Lead Content; 2011.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
- D. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 DRAINS

- A. Manufacturers:
 - 1. Mifab Manufacturing Inc.: www.mifab.com
 - 2. Josam Company; _____: www.josam.com.
 - 3. Jay R. Smith Manufacturing Company.
 - 4. Zurn Industries, LLC; _____: www.zurn.com.
- B. Floor Drain (FD-1):

1. ASME A112.21.1M; lacquered cast iron body with bottom outlet, combination invertible membrane clamp and adjustable collar with adjustable Type "B" polished nickel-bronze strainer .
2. Zurn Industries Model #Z-415 - 2" Outlet, 5" strainer.

2.03 CLEANOUTS (CO)

- A. Manufacturers:
1. Mifab Manufacturing Inc.: www.mifab.com
 2. Jay R. Smith Manufacturing Company; _____: www.jayrsmith.com.
 3. Josam Company; _____: www.josam.com.
 4. Zurn Industries, Inc.:
- B. Cleanouts at Exterior Surfaced Areas :
1. Round cast nickel bronze access frame and non-skid cover.
- C. Cleanouts at Exterior Unsurfaced Areas :
1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.
- D. Cleanouts at Interior Finished Floor Areas:
1. Adjustable floor cleanout, Lacquered cast iron body with agas and watertight ABS tapered thread plug, and round scoriated secured top (finish: polished nickel bronze) adjustable to floor finish. Coordinate floor finishes with architect prior to order.
 2. Zurn Industries, Inc.;; Model Z-1400
- E. Cleanouts at Interior Finished Wall Areas :
1. Lacquered cast iron body, gas and water tight ABS tapered thread plug, and round stainless steel access cover with vandal proof securing top.
 2. Zurn Industries, Inc.: Wall; Model Z-1441 or Z-1446

2.04 HYDRANTS

- A. Manufacturers:
1. Arrowhead Brass & Plumbing, LLC; _____: www.arrowheadbrass.com.
 2. Woodford; Model B65 www.wcmind.com
 3. Jay R. Smith Manufacturing Company; _____: www.jayrsmith.com.
 4. Zurn Industries, LLC; _____: www.zurn.com.
 5. Prier: www.prier.com
- B. Wall Hydrants: WH-1
1. ASSE 1019: Encased, non-freeze, anti siphon, automatic-draining type with polished bronze lockable recessed box, 1" male hose thread spout, lockshield and removable key, and integral back flow preventer.

2.05 BACKFLOW PREVENTERS

- A. Manufacturers:
1. Conbraco Industries, Inc; _____: www.apollovalves.com.
 2. Watts Regulator Company, a part of Watts Water Technologies; _____: www.wattsregulator.com.
- B. Reduced Pressure Backflow Preventers:
1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

2.06 WATER HAMMER ARRESTORS

- A. Manufacturers:
1. Mifab Manufacturing Inc.: www.mifab.com
 2. Jay R. Smith Manufacturing Company; _____: www.jayrsmith.com.

3. Watts Regulator Company, a part of Watts Water Technologies; _____:
www.wattsregulator.com.
 4. Zurn Industries, LLC; _____: www.zurn.com.
- B. Water Hammer Arrestors:
1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F and maximum 250 psi working pressure.

2.07 MIXING VALVES

- A. Thermostatic Mixing Valves:
1. Manufacturers:
 - a. Powers: www.powerscontrols.com.
 - b. Lawler: www.lawlervalve.com.
 - c. Leonard Valve Company: www.leonardvalve.com.
 2. Accessories:
 - a. Check valve on inlets.
 - b. Volume control shut-off valve on outlet.
 - c. Thermometer on outlet.
 - d. Strainer stop checks on inlets.
 3. Cabinet: 16 gage prime coated steel, for surface mounting with keyed lock.
- B. Shower Valves
1. Manufacturers:
 - a. Powers Model e710-J1 (standard shower), e710-8W (ADA shower)
 - b. Lawler
 2. Valve: ASSE 1016, type T/P compensating for 50% function in supply line pressures and compensate for changes in water supply temperatures. 5% approach temperature. Valve shall be cast brass with thermo actuator.
 3. Accessories:
 - a. Volume control shut-off valve on outlet.
- C. Under the Counter Mixing Valve
1. Manufacturers:
 - a. Powers type e480-10
 - b. Lawler
 2. Valve: ASSE 1016 type T/P. Valve shall be constructed of solid brass with actuator and control down to 0.5 GPM with a 5 deg approach temperature.
 3. Accessories:
 - a. Volume control shut-off valve on outlet.
 - b. Control temperature must be adjustable with locking nut.
 - c. Must have integral checkstops.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Coordinate clean-out locations with Architect prior to installation.
- C. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Install approved potable water protection devices where contamination of domestic water may occur; This includes fire sprinkler system.

- F. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, interior and exterior hose bibs.
- G. Pipe relief from backflow preventer to nearest drain.
- H. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatories, and sinks.

END OF SECTION

**SECTION 22 3000
PLUMBING EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water heaters.
- B. Pumps.
 - 1. Circulators.

1.02 REFERENCE STANDARDS

- A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; 2015.
- B. UL 1453 - Standard for Electric Booster and Commercial Storage Tank Water Heaters; Current Edition, Including All Revisions.
- C. ANSI Z21.10.3
- D. CSA 4.3
- E. ASME, Section IV
- F. ANSI/ASHRAE 15-1994, Section 8.13.6
- G. NEC

1.03 SUBMITTALS

- A. Product Data (Pumps):
 - 1. Indicate pump type, capacity, power requirements.
 - 2. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
 - 3. Provide electrical characteristics and connection requirements.
- B. Product Data (Water Heaters):
 - 1. Provide data sheet including dimensions, rated capacities, shipping weights, and accessories.
 - 2. Wiring diagram.
 - 3. Warranty information.
 - 4. Installation and operating instructions.
- C. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
- D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

- A. Performance (Pumps): Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.05 CERTIFICATIONS

- A. Water Heaters: NSF approved.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.06 WARRANTY

- A. Provide five year manufacturer warranty for domestic water heaters.

PART 2 PRODUCTS

2.01 WATER HEATER MANUFACTURERS

- A. Lochinvar Corporation: www.lochinvar.com.
- B. A.O. Smith Water Products Co; _____: www.hotwater.com.
- C. Bradford White: www.bradfordwhite.com

2.02 COMMERCIAL GAS FIRED WATER HEATERS

- A. Type: Automatic, natural gas-fired, vertical storage. Water heater shall be ASME inspected and stamped and National Board registered for 160 PSIG working pressure and 210 deg. F maximum allowable temperature.
- B. Performance:
 - 1. See Schedules
 - 2. Maximum working pressure: 150 psig.
- C. Tank: Glass lined welded steel ; multiple flue passages, 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.
- D. Heat Exchanger:
 - 1. The heat exchanger shall be of single-bank, vertical multi-pass design and shall completely enclose the combustion chamber for maximum efficiency. The tubes shall be set vertically and shall be rolled into a powder coated, ASME heater quality, carbon steel tube sheet.
 - 2. The heat exchanger shall be sealed to 160 PSIG rated bronze headers with silicone "O" rings, having a temperature rating over 500 deg. F.
 - 3. The heat exchanger shall be explosion-proof on the water side and shall carry a twenty (20) year warranty against thermal shock.
 - 4. The headers shall be secured to the tube sheet to permit inspection and maintenance without removal of external piping connections.
 - 5. The heater shall be capable of operating at inlet water temperatures as low as 120 deg. F without harmful condensation.
- E. Burner:
 - 1. The burner shall be capable of firing at 100% of rated input when supplied with 4.0" W.C. of inlet gas pressure, so as to maintain service under heavy demand conditions. The burner shall be capable of precisely controlling the fuel/air mixture for maximum efficiency throughout the entire range of modulation. Minimum fire shall be 25% of rated input.
- F. Gas Train:
 - 1. The heater(s) shall have a firing/leak test valve and pressure test valve as required.
 - 2. The heater(s) shall have dual-seated main gas valve.
 - 3. Gas control trains shall have redundant safety shut-off feature, main gas regulation, shut-off cock and plugged pressure tapping to meet the requirements of ANSI Z21.10.3/CSA
- G. Accessories: Brass water connections and dip tube, drain valve, magnesium anode, and ASME rated temperature and pressure relief valve.
- H. Certification: As automatic storage water heater and automatic circulating tank water heater for operation at 180 degrees F (82 degrees C) . CSA certification and ASME HLW Stamp and National Board Listed.

2.03 COMMERCIAL ELECTRIC WATER HEATERS

- A. Type: Factory-assembled and wired, electric, vertical storage.
- B. Performance:
 - 1. Performance as scheduled on drawings.

2. Maximum working pressure: 150 psig.
- C. Electrical Characteristics:
 1. 120 volts, single phase, 60 Hz.
- D. Tank: Glass lined welded steel; 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber encased in corrosion-resistant steel jacket; baked-on enamel finish.
- E. Controls: Moisture tight, completely enclosed thermostat, externally adjustable temperature range from 60 to 180 degrees F. Automatic overheat temperature limit thermostat.
- F. Accessories: Brass water connections and dip tube, drain valve, .84" magnesium anode, and ASME rated temperature, T & P pressure relief valve, with separate relief valve tapping.
- G. Heating Elements: Flange-mounted immersion elements; individual elements sheathed with Incoloy corrosion-resistant metal alloy, rated less than 75 Watts per square inch.

2.04 IN-LINE CIRCULATOR PUMPS

- A. Manufacturers:
 1. Armstrong Pumps Inc; _____: www.armstrongpumps.com.
 2. ITT Bell & Gossett; _____: www.bellgossett.com.
 3. Taco.
- B. Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.
- C. Impeller: Bronze.
- D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.
- E. Seal: Carbon rotating against a stationary ceramic seat.
- F. Drive: Flexible coupling.
- G. Performance:
 1. See schedules.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.
- B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.
- C. Pumps:
 1. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

END OF SECTION

**SECTION 22 4000
PLUMBING FIXTURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water closets
- B. Lavatories
- C. Sinks
- D. Service Sinks
- E. Garbage Disposals
- F. Drinking fountains.
- G. Showers.

1.02 SUBMITTALS

- A. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- B. Manufacturer's Instructions: Indicate installation methods and procedures.
- C. Maintenance Data: Include fixture trim exploded view and replacement parts lists.
- D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.03 QUALITY ASSURANCE

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

1.04 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept fixtures on site in factory packaging. Inspect for damage.
- B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Supply two sets of faucet washers.

PART 2 PRODUCTS

2.01 GENERAL

- A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 TANK TYPE WATER CLOSETS (WC-1)

- A. Tank Type Water Closet Manufacturers:
 - 1. American Standard Inc.; www.americanstandard-us.com.
 - 2. Sloan.
 - 3. Crane; .
 - 4. Kohler.
- B. Bowl:

1. ASME A112.19.2; wall hung, vitreous china, reverse trap, whirlpool action close-coupled closet combination with regular rim, insulated vitreous china closet tank with fittings and lever flushing valve, chrome plated bolt caps.
- C. Water Consumption:
 1. Maximum 1.28 gallon per flush.
- D. Seat Manufacturers:
 1. American Standard; Model [5311.012].
 2. Bemis Manufacturing Company; _____: www.bemismfg.com.
 3. Church Seat Company; _____: www.churchseats.com.
 4. Olsonite: www.olsonite.com. Model #40SSTL Round Closed Front with Cover.
 5. Olsonite: www.olsonite.com. Model #40SSTL Elongated Closed Front with Cover.
 6. Substitutions: See Section 01 6000 - Product Requirements.
- E. Seat:
 1. Solid white high gloss molded plastic, closed front, brass bolts, elongated seat with cover.
- F. Seat:
 1. Solid white plastic, open front, extended back, less cover, complete with self-sustaining hinge.

2.03 LAVATORIES (LAV-1)

- A. Manufacturers:
 1. Mansfield.
 2. American Standard.
 3. Kohler.
 4. Zurn.
 5. Sloan
- B. Vitreous China Wall Hung Basin:
 1. ASME A112.19.2M; vitreous china wall hung lavatory 19 x 17 inch minimum, rectangular basin with splash lip, front overflow, and soap depression.
- C. Supply Faucet Manufacturers:
 1. American Standard Inc; Model 7881.732 "Hampton": www.americanstandard.com..
 2. Delta.
 3. Elkay.
 4. Kohler.
 5. Symmons;.
- D. Supply Faucet:
 1. ASME A112.18.1M; chrome plated supply fitting with open grid strainer, water economy aerator with maximum 1.5 GPM flow, single lever handle.
- E. Supply Faucet - Sensor Operated:
 1. ADA Compliant, Sensor activated, 24 VAC, Chrome Plated Brass, Hand Washing Faucet with the following features Splash-proof Circuit Control Module, Sensor Range Adjustment Screw, Trouble Shooting LED Indicator Lights, User friendly Variable Time Out Settings, Filtered Solenoid Valve with serviceable "Y" Strainer Filter, 120 VAC/24 VAC Transformer (Plug-in or Box Mount), Vandal resistant Spray Head with Pressure Compensating Flow Control, Metal Jacket wire protection for Sensor and Solenoid Leads, Matching Trim Plate for 4" Center-Set sink, Modular Quick-Release Sensor and Solenoid Connections. Provide ASSE 1070 mixing valve for each faucet. Provide with 1 accessory EL-154 Transformer 120 VAC/24 VAC per 3 faucets.
 2. ASME A112.18.1M; chrome plated metered mixing faucet with low voltage operated solenoid operator and infrared sensor, spray and cover plate, open grid strainer.
- F. Accessories:
 1. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.

2. Offset waste with perforated open strainer.
3. Screwdriver stops.
4. Rigid supplies.
5. Carrier:
 - a. Manufacturers:
 - 1) JOSAM Company.
 - 2) J.R. Smith.
 - 3) Wade.
 - 4) Sloan Valve Company.
 - 5) Zurn Industries, Inc..
 - b. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, bearing plate and studs.

2.04 SINKS (SK-1)

- A. Manufacturers:
 1. American Standard.
 2. Just.
 3. Elkay.
- B. Single Compartment Bowl: ADA Compliant
 1. ASME A112.19.3M; 25 x 21 x 6 1/2 inch outside dimensions, 18 gage thick, Type 304 stainless steel, self-rimming and undercoated, with ledge back, and drilled holes for 4" on center trim.
 - a. Drain: 3 inch chromed brass drain.
- C. Supply Faucet Manufacturers:
 1. Elkay
 2. Kohler
 3. Delta
 4. Just
- D. Supply Faucet:
 1. ASME A112.18.1M; chrome plated supply fitting with water economy aerator with maximum 1.5 gpm flow, wrist blade handles, 6 inch radius goosneck 10.5 inch height, .090 inch spout wall thickness. Include vandal resistant features and screws.
- E. Accessories: Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon, screwdriver stop, rigid supplies.
- F. Garbage Disposal
 1. Provide Garbage Disposal for SK-1. Coordinate which drain to install disposal in with Architect.
 - a. Garbage disposal shall have stainless steel grind chamber, continuous feed, automatic reversing action with 1/2 HP 120V split phase motor and 7 year parts and service warranty.
 - b. Approved manufacturer:
 - 1) In-Sink-Erator

2.05 SHOWERS (SH-1)

- A. Shower Manufacturers:
 1. American Standard
 2. Delta; Model R10000-UNWS, T13H133 (shower valve only).
 3. Kohler Company
- B. Trim:
 1. ASME A112.18.1M; ADA compliant, concealed shower supply with pressure balanced mixing valve, integral service stops, vandal resistant metal lever handle.

2.06 DRINKING FOUNTAINS (DF-1)

2.07

- A. Drinking Fountain Manufacturers:
 - 1. Elkay Manufacturing Company; _____: www.elkay.com.
 - 2. Most Dependable Fountain.
 - 3. Haws Corporation; _____: www.hawesco.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Fountain:
 - 1. Molded white reinforced glass fiber with underside vandal proof cowling, hooded elevated anti-squirt bubbler with stream guard, automatic stream regulator, cross handle, mounting bracket, screwdriver stop.
- C. Fountain:
 - 1. Wall hung surface mounted, install one at standard height, and one at lower height for handicapped access, no lead design, vandal proof, stainless steel top and stainless steel body, hooded elevated anti-squirt flex guard safety bubbler with stream guard, automatic stream regulator, cross handle, mounting bracket, screwdriver stop. Operator push bars and spouts are machined from solid, stainless steel blocks. Push bars are recessed and protected by heavy steel plate. Push bar travel is limited to prevent all direct valve shock or abuse. Internal forged brass valve with easily replaceable, sealed cartridge, regulator. Water height adjustment through shielded hole in pushbar

2.08 MOP SINKS (MS-1)

- A. Manufacturers:
 - 1. Elkay Manufacturing Company.
 - 2. Just Manufacturing Company.
 - 3. Fiat Products; Model MSB-2424
- B. Bowl:
 - 1. 24 x 24 x 10 inch high white molded stone, floor mounted, with one inch wide shoulders, vinyl bumper guard, stainless steel strainer.
- C. Trim:
 - 1. ASME A112.18.1M exposed wall type supply with cross handles, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges. Equivalent to Delta model 28T9.
- D. Accessories:
 - 1. 5 feet of 1/2 inch diameter plain end reinforced rubber hose.
 - 2. Hose clamp hanger.
 - 3. Mop hanger.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Verify that electric power is available and of the correct characteristics.
- C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

- B. Install each fixture with trap, easily removable for servicing and cleaning.
- C. Provide chrome plated rigid or flexible supplies to fixtures with screwdriver stops, reducers, and escutcheons.
- D. Install components level and plumb.
- E. Install and secure fixtures in place with wall supports and bolts.
- F. Seal fixtures to wall and floor surfaces with sealant color to match fixture.
- G. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

- A. Clean plumbing fixtures and equipment.

3.07 PROTECTION

- A. Protect installed products from damage due to subsequent construction operations.
- B. Do not permit use of fixtures by construction personnel.
- C. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 23 0593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
 - 1. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. TAB Agency Qualifications:
 - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.

3.02 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- F. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- G. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- H. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- I. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

END OF SECTION

**SECTION 23 0713
DUCT INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Duct insulation.
- B. Duct Liner.

1.02 RELATED REQUIREMENTS

- A. Section 23 3100 - HVAC Ducts and Casings: Glass fiber ducts.

1.03 REFERENCE STANDARDS

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.
- B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.
- E. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- B. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE WRAP

- A. Manufacturer:
 - 1. Knauf Insulation: www.knaufusa.com.
 - 2. Johns Manville: www.jm.com.
 - 3. Owens Corning Corporation: www.ocbuildingspec.com.
- B. Insulation: ASTM C553; flexible, noncombustible blanket.
 - 1. 'K' value: 0.31 at 75 degrees F, when tested in accordance with ASTM C518.
 - 2. Maximum Service Temperature: 1200 degrees F.
 - 3. Maximum Water Vapor Absorption: 5.0 percent by weight.
- C. Insulation shall be 1.5 lb/cu. ft. density. Refer to Schedule below for thickness.
- D. Vapor Barrier Jacket:
 - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 - 2. Secure with pressure sensitive tape.

- E. Vapor Barrier Tape:
 - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- F. Tie Wire: Annealed steel, 16 gage, 0.0508 inch diameter.

2.03 DUCT LINER

- A. Manufacturers:
 - 1. Knauf Insulation: www.knaufusa.com.
 - 2. Johns Manville: www.jm.com.
 - 3. Owens Corning Corp; Model Fiberglas Duct Liner Board: www.owenscorning.com.
- B. Insulation: ASTM C 1071; flexible, noncombustible blanket with poly vinyl acetate polymer impregnated surface and edge coat.
 - 1. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
 - 2. Service Temperature: Up to 250 degrees F.
 - 3. Maximum Velocity on Coated Air Side: 5,000 fpm.
 - 4. Minimum Noise Reduction Coefficients:
 - 5. 1 inch Thickness: 0.45.
- C. Adhesive: Waterproof, fire-retardant type, ASTM C916.
- D. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.
 - 1. Density: 1.5 lb/cu ft
 - 2. Liner shall meet Anti-Bacterial Requirements of ASTM C 1071, ASTM G 21 and ASTM G 22
 - 3. Liner shall be cleanable in accordance with NAIMA "Duct Cleaning Guide."

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that ducts have been pressure and leak tested before applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Insulated ducts conveying air below ambient temperature:
 - 1. Provide insulation with vapor barrier jackets.
 - 2. Finish with tape and vapor barrier jacket.
 - 3. Continue insulation through walls penetrtrions and at hanger connections.
 - 4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- D. External Duct Insulation Application:
 - 1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
 - 2. Secure insulation without vapor barrier with staples, tape, or wires.
 - 3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
 - 4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
 - 5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- E. Duct and Plenum Liner Application:
 - 1. Adhere insulation with adhesive for 90 percent coverage.
 - 2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
 - 3. Seal and smooth joints. Seal and coat transverse joints.

4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.
6. Provide nosing on all exposed fiberglass edges.

3.03 SCHEDULES

- A. Exhaust Ducts Within 10 ft of Exterior Openings:
 1. Flexible Glass Fiber Duct Insulation: 1 inches thick.
- B. Outside Air Intake Ducts:
 1. Flexible Glass Fiber Duct Insulation: 1 inches thick.
- C. Outside Air and Exhaust Air Plenums:
 1. Flexible Glass Fiber Duct Insulation: 1 inches thick.
- D. Return Air Ductwork (located in plenum/conditioned space):
 1. Duct Liner: 1 inches thick (first ten feet only) from unit.
- E. Supply Ductwork (located in plenum or unconditioned spaces):
 1. Flexible Glass Fiber Duct Insulation: 1 inches thick.

END OF SECTION

**SECTION 23 2300
REFRIGERANT PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping.
- B. Refrigerant.
- C. Moisture and liquid indicators.
- D. Valves.
- E. Strainers.
- F. Filter-driers.
- G. Solenoid valves.

1.02 REFERENCE STANDARDS

- A. AHRI 710 - Performance Rating of Liquid-Line Driers; 2009.
- B. AHRI 760 - Standard for Performance Rating of Solenoid Valves for Use With Volatile Refrigerants; 2007.
- C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.
- D. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2013.
- E. ASME B31.9 - Building Services Piping; 2014.
- F. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2013.
- G. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.
- H. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

1.03 SYSTEM DESCRIPTION

- A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.
- C. Liquid Indicators:
 - 1. Use line size liquid indicators in main liquid line leaving condenser.
- D. Valves:
 - 1. Use service valves on suction and discharge of compressors.
 - 2. Use gage taps at compressor inlet and outlet.
- E. Refrigerant Charging (Packed Angle) Valve: Use in liquid line between receiver shut-off valve and expansion valve.
- F. Strainers:
 - 1. Use line size strainer upstream of each automatic valve.
- G. Filter-Driers:
 - 1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.
- H. Solenoid Valves:
 - 1. Use in liquid line of systems operating with single pump-out or pump-down compressor control.

1.04 SUBMITTALS

- A. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

PART 2 PRODUCTS

2.01 PIPING

- A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.
 - 1. Fittings: ASME B16.22 wrought copper.
 - 2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.
- B. Pipe Supports and Anchors:
 - 1. Provide hangers and supports that comply with MSS SP-58.
 - a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 - 2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
 - 3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - 4. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
 - 5. Vertical Support: Steel riser clamp.
 - 6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
 - 7. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
 - 8. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.02 MOISTURE AND LIQUID INDICATORS

- A. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.03 VALVES

- A. Diaphragm Packless Valves:
 - 1. UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, solder or flared ends, with positive backseating; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.
- B. Packed Angle Valves:
 - 1. Forged brass or nickel plated forged steel, forged brass seal caps with copper gasket, rising stem and seat with backseating, molded stem packing, solder or flared ends; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.
- C. Ball Valves:
 - 1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F.
- D. Service Valves:
 - 1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi.

2.04 STRAINERS

- A. Straight Line or Angle Line Type:
 - 1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

2.05 FILTER-DRIERS

- A. Performance:
 - 1. Flow Capacity - Liquid Line: As indicated in schedule, minimum, rated in accordance with AHRI 710.
 - 2. Pressure Drop: 2 psi, maximum, when operating at full connected evaporator capacity.
 - 3. Design Working Pressure: 350 psi, minimum.
- B. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.
- C. Construction: UL listed.
 - 1. Connections: As specified for applicable pipe type.

2.06 SOLENOID VALVES

- A. Valve: AHRI 760 I-P, pilot operated, copper, brass or steel body and internal parts, synthetic seat, stainless steel stem and plunger assembly (permitting manual operation in case of coil failure), integral strainer, with flared, solder, or threaded ends; for maximum working pressure of 500 psi.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

- A. Install refrigeration specialties in accordance with manufacturer's instructions.
- B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.
- C. Install piping to conserve building space and avoid interference with use of space.
- D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Test refrigeration system in accordance with ASME B31.5.
- C. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using halide torch. Test to no leakage.

3.04 SCHEDULES

- A. Hanger Spacing for Copper Tubing.
 - 1. 1/2 inch, 5/8 inch, and 7/8 inch OD: Maximum span, 5 feet; minimum rod size, 1/4 inch.
 - 2. 1-1/8 inch OD: Maximum span, 6 feet; minimum rod size, 1/4 inch.
 - 3. 1-3/8 inch OD: Maximum span, 7 feet; minimum rod size, 3/8 inch.
 - 4. 1-5/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 - 5. 2-1/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.

END OF SECTION

**SECTION 23 3100
HVAC DUCTS AND CASINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single-wall rectangular ducts and fittings.
- B. Hangers and supports.

1.02 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.
- C. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2012, 2nd Edition.
- D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.
- E. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

1.03 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.04 SUBMITTALS

- A. Product Data: Provide data for duct materials, duct liner, duct connections, and factory fabricated fittings.
- B. Shop Drawings: Submit 1/4 scale, double line shop drawings that indicate duct fittings, duct size, bottom of duct elevations, necessary offsets to accommodate building structure, particulars such as gages, sizes, welds, elevations, all fittings, and configuration prior to start of work for all systems.

1.05 REGULATORY REQUIREMENTS

- A. Construct ductwork to NFPA 90A standards.
- B. Construct ductwork to SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 1995, Second Edition with Addendum No. 1.

PART 2 PRODUCTS

2.01 SINGLE-WALL RECTANGULAR DUCT AND FITTING ASSEMBLIES

- A. Regulatory Requirements: Construct ductwork to NFPA 90A standards.
- B. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints,"

for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

- D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- E. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.02 MATERIALS

- A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
- B. General Material Requirements: 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.
- C. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.

2.03 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.04 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.
- B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- C. Provide turning vanes in all mitered elbows.
- D. T's, bends, and elbows: Construct according to SMACNA (DCS).

- E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- F. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).
- G. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.
- H. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.
- I. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.05 MANUFACTURED DUCTWORK AND FITTINGS

- A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
- B. Install in accordance with manufacturer's instructions.
- C. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- D. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- E. Install ducts with fewest possible joints.
- F. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- H. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- I. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- J. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.
- K. Use double nuts and lock washers on threaded rod supports.
- L. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- M. At exterior wall louvers, seal duct to louver frame and install blank-out panels.

3.02 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.

2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.03 DUCT CLEANING

- A. Clean new duct system(s) before testing, adjusting, and balancing.
- B. Clean the following components by removing surface contaminants and deposits:
1. Air outlets and inlets (registers, grilles, and diffusers).
 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
 4. Coils and related components.
 5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
 6. Supply-air ducts, dampers, actuators, and turning vanes.
- C. Mechanical Cleaning Methodology:
1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
 2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
 3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
 4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
 5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
 6. Provide drainage and cleanup for wash-down procedures.
 7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.04 FIELD QUALITY CONTROLS

- A. Perform tests and inspections.

- B. Leakage Tests:
 - 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 - 2. Test the following systems:
 - a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections, selected by Architect from sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.
 - 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 - 4. Keep open ends of ductwork covered during construction.
 - 5. Test for leaks before applying external insulation.
 - 6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
 - 7. Give seven days' advance notice for testing.
- C. Duct System Cleanliness Tests:
 - 1. Visually inspect duct system to ensure that no visible contaminants are present.
 - 2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCAACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.05 SCHEDULES

- A. Supply Ducts:
 - 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive 1-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
- B. Return Ducts:
 - 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 1-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
- C. Exhaust Ducts:
 - 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: C if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
- D. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
 - 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
- E. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity 1000 to 1500 fpm:
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
- F. Branch Configuration:
 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.
 - 1) Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - c. Velocity 1000 fpm or Lower: 90-degree tap.
 - d. Velocity 1000 to 1500 fpm: Conical tap.
 - e. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION

**SECTION 23 3300
AIR DUCT ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air turning devices/extractors.
- B. Backdraft dampers - metal.
- C. Duct access doors.
- D. Duct test holes.
- E. Flexible duct connections.
- F. Volume control dampers.

1.02 SUBMITTALS

- A. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

- A. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.02 BACKDRAFT DAMPERS

- A. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.03 DUCT ACCESS DOORS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.

2.04 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.05 FLEXIBLE DUCT CONNECTIONS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.
- B. Flexible Duct Connections: Fabric crimped into metal edging strip.

2.06 VOLUME CONTROL DAMPERS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.
- B. Single Blade Dampers: Fabricate for duct sizes up to 6 by 30 inch.
 - 1. Blade: 24 gage, 0.0239 inch, minimum.
- C. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
 - 1. Blade: 18 gage, 0.0478 inch, minimum.

- D. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.
- E. Quadrants:
 - 1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
 - 2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
 - 3. Where rod lengths exceed 30 inches provide regulator at both ends.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 3100 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, and elsewhere as indicated. Provide minimum 8 by 8 inch size for hand access, size for shoulder access, and as indicated. Provide 4 by 4 inch for balancing dampers only. Review locations prior to fabrication.
- D. Provide duct test holes where indicated and required for testing and balancing purposes.
- E. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
- F. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
- G. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

**SECTION 23 3423
POWER VENTILATORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall exhausters.
- B. Ceiling exhaust fans.

1.02 SUBMITTALS

- A. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

1.03 FIELD CONDITIONS

- A. Permanent ventilators may not be used for ventilation during construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Greenheck: www.greenheck.com.
- B. Loren Cook Company: www.lorencook.com.
- C. PennBarry: www.pennbarry.com.

2.02 POWER VENTILATORS - GENERAL

- A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.
- B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.
- C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.
- D. Fabrication: Conform to AMCA 99.
- E. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.03 WALL EXHAUSTERS

- A. Fan Unit: V-belt or direct driven with spun aluminum housing; resiliently mounted motor; 1/2 inch mesh, 0.062 inch thick aluminum wire bird screen.
- B. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.
- C. Sheaves: For V-belt drives, provide cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.04 CABINET AND CEILING EXHAUST FANS

- A. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.
- B. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.
- C. Grille: Molded white plastic.
- D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide sheaves required for final air balance.
- C. Install backdraft dampers on inlet to roof and wall exhausters.
- D. Provide backdraft dampers on outlet from cabinet and ceiling exhausters fans.

END OF SECTION

SECTION 23 3700
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Diffusers.
- B. Registers/grilles.
- C. Louvers.

1.02 REFERENCE STANDARDS

- A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2012.
- B. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets; 2006 (R2011).
- C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

1.03 SUBMITTALS

- A. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.04 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.
- B. Test and rate louver performance in accordance with AMCA 500-L.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hart & Cooley, Inc: www.hartandcooley.com.
- B. Krueger: www.krueger-hvac.com.
- C. Price Industries: www.price-hvac.com.
- D. Titus: www.titus-hvac.com.

2.02 WALL SUPPLY REGISTERS/GRILLES

- A. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, vertical face, single deflection.
- B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.
- C. Fabrication: Steel with 20 gage, 0.0359 inch minimum frames and 22 gage, 0.0299 inch minimum blades, steel and aluminum with 20 gage, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.
- D. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.

2.03 WALL EXHAUST AND RETURN REGISTERS/GRILLES

- A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, vertical face.
- B. Frame: 1-1/4 inch margin with countersunk screw mounting.
- C. Fabrication: Steel frames and blades, with factory baked enamel finish.
- D. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.04 FLOOR SUPPLY REGISTERS/GRILLES

- A. Individually adjustable blades, wide stamped border, single or double blade damper with set screw adjustment.

- B. Fabricate of steel, welded construction, with factory baked enamel finish.

2.05 INTAKE AND RELIEF LOUVERS

- A. Louver Manufacturers:
 - 1. Greenheck; Model ESD-603.
 - 2. Ruskin.
- B. Quality Assurance:
 - 1. Louvers licensed to bear AMCA Certified Ratings Seal. Ratings based on tests and procedures performed in accordance with AMCA 511 and comply with AMCA Certified Ratings Program. AMCA Certified Ratings Seal applies to air performance and water penetration ratings.
- C. Fabrication:
 - 1. Frame:
 - a. Material: Extruded aluminum, Alloy 6063-T5.
 - b. Wall Thickness: 0.081 inch (2.1mm), nominal.
 - c. Depth: 4 inches.
 - 2. Blades:
 - a. Style: Drainable.
 - b. Material: Extruded aluminum, Alloy 6063-T5.
 - c. Wall Thickness: 0.081 inch (2.1mm), nominal.
 - d. Angle: 37 degrees.
 - e. Centers: 4 inches.
 - 3. Bird Screen:
 - a. Material: Aluminum, 3/4 inch x 0.51 inch expanded, flattened.
 - b. Frame: Removeable, rewireable.
 - 4. Vertical Supports: Hidden vertical supports to allow continuous line appearance up to 120 inches.
 - 5. Sill: Steeply angles integral sill eliminating areas of standing or trapped moisture where mold or mildew may thrive and effect indoor air quality.
 - 6. Assembly: Factory assemble louver components.
- D. Performance Data:
 - 1. Design Load: Incorporate structural supports required to withstand wind load of 25 pounds per square foot (100 mph wind equivalent).
- E. Factory Finish:
 - 1. Baked Enamel Finish:
 - a. Color shall be as selected by architect.
 - b. Finish to be applied after a thorough cleaning and preparation of the metal surface.
 - c. Total dry film thickness: 1.2 mils.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

END OF SECTION

**SECTION 23 5400
FURNACES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Forced air furnaces, split system.

1.02 REFERENCE STANDARDS

- A. ANSI Z21.47 - American National Standard for Gas-Fired Central Furnaces; 2012.
- B. NFPA 54 - National Fuel Gas Code; 2015.
- C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.
- D. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2015.
- E. NFPA 211 - Guide for Smoke and Heat Venting; 2013, Including All Amendments.

1.03 SUBMITTALS

- A. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
- B. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.
- C. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.
- D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Carrier Corporation, a brand of United Technologies Corporation Building & Industrial Systems: www.carrier.com.
- B. Trane Inc, a subsidiary of Ingersoll Rand: www.trane.com.
- C. York International Corporation / Johnson Controls: www.york.com.
- D. Lennox Industries, Inc.

2.02 GAS FIRED FURNACES

- A. Annual Fuel Utilization Efficiency (AFUE): 0.95 ("condensing").
- B. Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating element, controls, air filter, humidifier, and accessories; wired for single power connection with control transformer.
 - 1. Safety certified by CSA in accordance with ANSI Z21.47.
 - 2. Venting System: Concentric.
 - 3. Combustion: Sealed
 - 4. Air Flow Configuration: Downflow.
 - 5. Heating: Natural gas fired.
- C. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner. If not certified for combustible flooring, please provide additional steel base.
- D. Primary Heat Exchanger:
 - 1. Material: Hot-rolled steel.
 - 2. Shape: Tubular type.
- E. Secondary Heat Exchanger:
 - 1. Material: Aluminized steel.

- F. Gas Burner:
 - 1. Atmospheric type with adjustable combustion air supply.
 - 2. Gas valve, two stage provides 100 percent safety gas shut-off; 24 volt combining pressure regulation, safety pilot, manual set (On-Off), pilot filtration, automatic electric valve.
 - 3. Electronic pilot ignition, with electric spark igniter.
 - 4. Combustion air damper with synchronous spring return damper motor.
 - 5. Non-corrosive combustion air blower with permanently lubricated motor.
- G. Gas Burner Safety Controls:
 - 1. Thermocouple sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.
 - 2. Flame rollout switch: Installed on burner box and prevents operation.
 - 3. Vent safety shutoff sensor: Temperature sensor installed on draft hood and prevents operation, manual reset.
 - 4. Limit Control: Fixed stop at maximum permissible setting, de-energizes burner on excessive bonnet temperature, automatic resets.
- H. Supply Fan: Centrifugal type rubber mounted with direct drive with adjustable variable pitch motor pulley.
- I. Motor:
 - 1. 1750 rpm single-speed, permanently lubricated, hinge mounted.
- J. Air Filters: 1 inch thick urethane, washable type arranged for easy replacement.
- K. Operating Controls
 - 1. Room Thermostat: Cycles burner to maintain room temperature setting.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.
- B. Verify that proper power supply is available and located correctly.
- C. Verify that proper fuel supply is available for connection.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions and requirements of authorities having jurisdiction.
- B. Install in accordance with NFPA 90A.
- C. Install gas fired furnaces in accordance with NFPA 54.
- D. Provide vent connections in accordance with NFPA 211.

END OF SECTION

SECTION 23 8200
CONVECTION HEATING AND COOLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electric unit heaters.
- B. Electric cabinet unit heaters.

1.02 SUBMITTALS

- A. Product Data: Provide typical catalog of information including arrangements.
- B. Shop Drawings:
 - 1. Indicate air coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.

1.03 QUALITY ASSURANCE

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 ELECTRIC UNIT HEATERS

- A. Manufacturers:
 - 1. INDEECO (Industrial Engineering and Equipment Company): www.indeeco.com.
 - 2. Modine Manufacturing Company: www.modineHVAC.com.
 - 3. Trane, a brand of Ingersoll Rand: www.trane.com.
- B. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to Authority Having Jurisdiction as suitable for the purpose indicated.
- C. Assembly: Suitable for mounting from ceiling or structure above with built-in controls, thermal safety cut-out, and electric terminal box.
- D. Acceptable Heating Element Assemblies:
 - 1. Horizontal Projection Units:
 - a. Steel fins copper brazed to steel sheath and epoxy sealed for moisture resistance.
- E. Housing:
 - 1. Horizontal Projection Units:
 - a. Construction materials to consist of heavy gage steel with galvanized, polyester powder coat, or high gloss baked enamel finish.
 - b. Provide with threaded holes for threaded rod suspension.
 - c. Provisions for access to internal components for maintenance, adjustments, and repair.
- F. Air Inlets and Outlets:
 - 1. Inlets: Provide stamped louvers or protective grilles with fan blade guard.
 - 2. Outlets: Provide diffuser cones, directional louvers, or radial diffusers.
- G. Fan: Factory balanced, direct drive, axial type with fan guard.
- H. Motor: Totally enclosed, thermally protected, and provided with permanently lubricated bearings.

2.02 ELECTRIC CABINET UNIT HEATERS

- A. Manufacturers:
 - 1. INDEECO (Industrial Engineering and Equipment Company): www.indeeco.com.
 - 2. Marley Engineered Products: www.marleymep.com.
 - 3. Trane, a brand of Ingersoll Rand: www.trane.com.

- B. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to Authority Having Jurisdiction as suitable for the purpose indicated.
- C. Heating Elements: Provide open-wire, finned tubular, or resistance wire enclosed in steel sheath.
- D. Cabinet: Minimum 18 gage, 0.0478 inch thick steel front panel with exposed corners and edges rounded, easily removed panels, glass fiber insulation and integral air outlet, and inlet grilles.
- E. Finish:
 - 1. Factory applied, painted finish.
 - 2. Color: As selected from color chart.
- F. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven.
- G. Motor: Tap wound multiple speed permanent split capacitor with sleeve bearings, resiliently mounted.
- H. Controls:
 - 1. Thermostat.
- I. Filter: Easily removed, 1 inch thick glass fiber throw-away type, located to filter air before coil.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's recommendations.
- B. Install equipment exposed to finished areas after walls and ceilings are finished and painted.
- C. Do not damage equipment or finishes.
- D. Unit Heaters:
 - 1. Hang from building structure, with pipe hangers anchored to building, not from piping or electrical conduit.
 - 2. Mount as high as possible to maintain greatest headroom unless otherwise indicated.
- E. Cabinet Unit Heaters:
 - 1. Install as indicated.
 - 2. Coordinate to ensure correct recess size for recessed units.

END OF SECTION

SECTION 26 0500
BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions, Special Conditions and Division 1 specification sections, apply to work of this section.
- B. Provide all items, articles, materials, operations or methods listed, mentioned or scheduled on drawings and/or herein, including all labor, materials, equipment and incidentals necessary and required for their completion.
- C. The items in this section are supplementary to the requirements set forth in other portions of the specifications as indicated under Item "A" above.

1.02 DRAWINGS

- A. The drawings show the location and general arrangement of equipment, electrical systems and related items. They shall be followed as closely as elements of the construction will permit.
- B. Examine the drawings of other trades and verify the conditions governing the work on the job site. Arrange work accordingly, providing such fittings, conduit, junction boxes and accessories as may be required to meet such conditions.
- C. Deviations from the drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect/Engineer.
- D. The architectural and structural drawings take precedence in all matters pertaining to the building structure, mechanical drawings in all matters pertaining to mechanical trades and electrical drawings in all matters pertaining to electrical trades. Where there are conflicts or differences between the drawings for the various trades, report such conflicts or differences to the Architect/Engineer for resolution.

1.03 INSPECTION OF SITE

- A. Visit the site, examine and verify the conditions under which the work must be conducted before submitting proposal.
- B. The submitting of a proposal implies that the contractor has visited the site and understands the conditions under which the work must be conducted.

1.04 CONTRACT BREAKDOWN

- A. Within two (2) weeks following award of contract, submit to the Architect/Engineer for approval a contract amount breakdown. Breakdown shall be submitted on a form similar to the form available at the Architect/Engineer's office. All requests for payment shall be based on the approved breakdown.

1.05 TEMPORARY FACILITIES

- A. Provide and remove upon completion of the project, in accordance with the general conditions, a complete temporary electrical and telephone service during construction.

1.06 ALTERNATES

- A. See Alternate Section and other applicable parts of the specifications.

1.07 GUARANTEE

- A. Contractor guarantees that the installation is free from defects and agrees to replace or repair, any part of this installation which becomes defective within a period of one year following final acceptance, unless noted otherwise, provided that such failure is due to defects in the equipment, material or installation or to follow the specifications and drawings. File with the Owner any and all guarantees from the equipment manufacturers.

1.08 CODES, PERMITS AND FEES

- A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for electrical work shall be secured and paid for by the contractor. All work shall conform to all applicable codes, rules and regulations.
- B. Rules of local utility companies shall be complied with. Check with the utility company supplying service to the installation and determine all devices including, but not limited to, all current and potential transformers, meter boxes, C.T. cabinets and meters which will be required and include the cost of all such items in proposal.
- C. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed drawings or diagrams which may be required by the governing authorities. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern.

1.09 STANDARDS OF MATERIAL AND WORKMANSHIP:

- A. All materials shall be new. The electrical and physical properties of all materials, and the design, performance characteristics, and methods of construction of all items of equipment, shall be in accordance with the latest issue of the various, applicable Standard Specifications of the following recognized authorities:
 - 1. A.N.S.I.American National Standards Institute
 - 2. A.S.T.M.American Society for Testing Materials
 - 3. I.C.E.A.Insulated Cable Engineers Association
 - 4. I.E.E.E.Institute of Electrical and Electronics Engineers
 - 5. N.E.C.National Electrical Code
 - 6. N.E.M.A.National Electrical Manufacturer's Association
 - 7. U.L.Underwriters Laboratories, Inc.
- B. Perform all work in a first class and workmanlike manner, in accordance with the latest accepted standards and practices for the Trades involved.
- C. All equipment of the same or similar systems shall be by the same manufacturer.

1.10 RECORD DRAWINGS

- A. Provide complete operating and maintenance instruction manuals covering all electrical equipment herein specified, together with parts lists. All literature shall be furnished in triplicate for Owner and shall be bound in book or ring binder form as directed by Architect/ Engineer.
- B. The operating and maintenance instructions shall include a brief, general description for all electrical systems including, but not limited to:
- C. Routine maintenance procedures.
- D. Trouble-shooting procedures.
- E. Shop Drawings
- F. Any equipment offered as a substitution shall be equal in quality, durability, appearance, ampacity, and efficiency through all ranges of operation, shall conform with arrangements and space limitations of the equipment shown on the plans and/or specified, shall be compatible with the other components of the system. All costs to make these items of equipment comply with these requirements including, but not limited to, conduit, wiring, bus work, enclosures and building alterations shall be included in the original bid. Similar equipment shall be by one manufacturer.

1.11 SHOP DRAWINGS/SUBMITTALS

- A. All shop drawings shall be submitted in groupings of similar and/or related items (lighting fixtures, switchgear, etc.). Incomplete submittal groupings will be returned unchecked.
- B. Submit for approval eight (8) copies of shop drawings for all electrical systems or equipment but not limited to the items listed below. Where items are referred to by symbolic designation on

the drawings and specifications, all submittals shall bear the same designation (light fixtures). Refer to other sections of the electrical specifications for additional requirements.

1. Receptacle Distribution Switchboard
2. Panelboards
3. Motor Control
4. Disconnect Switches
5. Time Switches
6. Wiring Devices
7. Lighting Fixtures
8. Handholes
9. Surface Raceways

1.12 MANUFACTURERS LISTED

- A. The listing of specific manufacturers does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed are not relieved from meeting these specifications in their entirety.
- B. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

1.13 USE OF EQUIPMENT

- A. The use of any equipment, or any part thereof for purposes other than testing even with the Owner's consent, shall not be construed to be an acceptance of the work on the part of the Owner, nor be construed to obligate the Owner in any way to accept improper work or defective materials.
- B. Do not use Owner's lamps for temporary lighting except as allowed and directed by the Owner. Equip lighting fixtures with new lamps when the project is turned over to the Owner.

PART 2 EXECUTION

2.01 INSTALLATION OF EQUIPMENT

- A. Install all equipment in strict accordance with all directions and recommendations furnished by the manufacturer. Where such directions are in conflict with the drawings and specifications, report such conflicts to the Architect/Engineer for resolution.

2.02 COORDINATION

- A. Install work to avoid interference with work of other trades including, but not limited to, architectural and mechanical trades. Remove and relocate any work that causes an interference at contractor's expense. Disputes regarding the cause of an interference will be resolved by the Construction Manager or Architect/Engineer.

2.03 CHASES AND RECESSES

- A. Provided by the architectural trades, but the contractor shall be responsible for their accurate location and size.

2.04 CUTTING, PATCHING AND DAMAGE TO OTHER WORK

- A. Refer to General Conditions for requirements.
- B. All cutting, patching and repair work shall be performed by the contractor through approved, qualified subcontractors. Contractor shall include full cost of same in bid.

2.05 EXCAVATION AND BACKFILLING

- A. Provide all excavation, trenching, tunneling, dewatering and backfilling required for the electrical work. Coordinate the work with other excavating and backfilling in the same area.
- B. Where conduit is installed less than 2"6" below the surface of pavement, provide concrete encasement, 4" minimum coverage, all around or as shown on the electrical drawings.

- C. Backfill all excavations inside building, under drives and parking areas with well-tamped granular material. Backfill all excavations under wall footings with lean mix concrete up to underside of footings and extend concrete within excavation a minimum of four (4) feet each side of footing. Granular backfill shall be placed in layers not more than 8 inches in thickness, 95 percent compaction throughout with approved compaction equipment. Tamp, roll as required. Excavated material shall not be used.
- D. Backfill outside building with granular material to a height 12 inches over top of pipe compacted to 95 percent compaction as specified above. Backfill remainder of excavation with unfrozen, excavated material in such a way to prevent settling. Tamp, roll as required.

2.06 EQUIPMENT FOUNDATION AND SUPPORTS

- A. Shall be as required or as shown on plans or specified.
- B. Provide concrete bases and supports for floor mounted electrical equipment.
- C. Provide concrete house keeping bases 4" above finished floor, with leveling channels, where noted, for floor-mounted equipment.
- D. For equipment suspended from ceilings or walls, furnish and install all inserts, rods, structural steel frames, brackets and platforms required.

2.07 EQUIPMENT CONNECTIONS

- A. Make connections to equipment, motors, lighting fixtures, and other items included in the work in accordance with the approved shop drawings and rough-in measurements furnished by the manufacturers of the particular equipment furnished. All additional connections not shown on the drawings, but called out by the equipment manufacturer's shop drawings shall be provided.

2.08 ACCESS DOORS

- A. Provide access doors for installation by architectural trades. In the walls, provide Milcor No. "DW" or "M" as required to make all controls, electrical boxes and other equipment installed by the contractor accessible. Minimum size 12 inches x 12 inches. In the ceiling, provide Milcor No. 3210, 3105 or 3206 for accessibility as mentioned above, 24 inches x 24 inches minimum size. The plaster or acoustical tile insert shall be by the architectural trades. Areas with accessible ceilings (ceilings where tiles are not fastened in place and can be individually removed without removal of adjacent tiles) will not require access doors.
- B. When access doors are in fire resistant wall or ceilings, they must bear the Underwriter's Laboratories, Inc., Label, with time design rating equal to or exceeding that of the wall or ceiling unless they were a part of the tested assembly.

2.09 CLEANING

- A. All debris shall be removed daily as required to maintain the work area in a neat, orderly condition.
- B. Final cleanup shall include, but not be limited to, washing of fixture lenses or louvers, switchboards, substations, motor control centers, panels, etc. Fixture reflectors and lenses or louvers shall be left with no water marks or cleaning streaks.

2.10 PROTECTION AND HANDLING OF EQUIPMENT AND MATERIALS

- A. Equipment and materials shall be protected from theft, injury or damage.
- B. Protect conduit openings with temporary plugs or caps.
- C. Provide adequate storage for all equipment and materials delivered to the job site. Location of the space will be designated by the Construction Manager or Architect/Engineer. Equipment set in place in unprotected areas must be provided with temporary protection.

2.11 NAMEPLATES AND DIRECTORIES

- A. Identify switchgear, motor controls, panelboards, safety switches, etc., with manufacturer's nameplate, shop order, where applicable on composite assemblies, and designations used on

the Drawings. Nameplates shall be laminated phenolic plastic, beveled edged white with engraved black letters. Except where impractical, letters and numerals shall be a minimum of 1/4 inch high. Nameplates shall be mechanically secured. Pressure sensitive nameplates are not acceptable. Panel directories shall be neatly typed, showing equipment served and location for each breaker or switch with a clear plastic protective cover.

- B. For detailed requirements refer to Section 26 0553 IDENTIFICATION FOR ELECTRICAL SYSTEMS.

2.12 EXTRA WORK

- A. For any extra electrical work which may be proposed, this Contractor shall furnish to the Construction Manager, an itemized breakdown of the estimated cost of the materials and labor required to complete this work. The Contractor shall proceed only after receiving a written order from the Construction Manager establishing the agreed price and describing the work to be done.

2.13 DRAWINGS AND MEASUREMENTS

- A. These Specifications and accompanying Drawings are intended to describe and provide for finished work. They are intended to be cooperative, and what is called for by either shall be as binding as if call for by both. The Contractor will understand that the work herein described shall be complete in every detail.
- B. The Drawings are not intended to be scaled for rough-in measurements nor to serve as Shop Drawings. Field measurements necessary for ordering materials and fitting the installation to the building construction and arrangement shall be taken by the Contractor. The Contractor shall check latest Architectural drawings and locate light switches from same where door swings are different from Electrical Drawings.

END OF SECTION

**SECTION 26 0501
MINOR ELECTRICAL DEMOLITION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical demolition.

1.02 SUMMARY

- A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, and services to completely execute the system of minor electrical demolition as described in this specification.
- B. The demolition documents plans and specification have been prepared from existing non-as built documents and cursory non-invasive field investigation.
- C. It is the contractors obligation to become familiar with the extent of demolition and the existing condition before submitting their bid.
- D. During demolition if the contractor discovers unforeseen significant non code compliance conditions of the existing installation they shall notify the Architect and Engineer immediately in writing.
- E. During demolition the contractor shall record on the as-builts all demolished circuits numbers that can be used for new circuiting.

1.03

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that abandoned wiring and equipment serve only abandoned facilities.
- B. Demolition drawings are based on casual field observation and existing record documents.
- C. Report discrepancies to Owner before disturbing existing installation.
- D. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings to be removed.
- B. Coordinate utility service outages with utility company.
- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Remove, relocate, and extend existing installations to accommodate new construction.
- B. Remove abandoned wiring to source of supply.
- C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
- D. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.
- E. Disconnect and remove abandoned panelboards and distribution equipment.

- F. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
- G. Repair adjacent construction and finishes damaged during demolition and extension work.
- H. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
- I. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.04 CLEANING AND REPAIR

- A. See Section 01 7419 - Construction Waste Management and Disposal for additional requirements.
- B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

END OF SECTION

SECTION 26 0519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single conductor building wire.
- B. Nonmetallic-sheathed cable.
- C. Underground feeder and branch-circuit cable.
- D. Service entrance cable.
- E. Wiring connectors.
- F. Electrical tape.
- G. Wire pulling lubricant.
- H. Cable ties.

1.02 RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping.
- B. Section 26 0501 - Minor Electrical Demolition: Disconnection, removal, and/or extension of existing electrical conductors and cables.
- C. Section 26 0526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
- D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 2100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conductors.
- F. Section 28 3100 - Fire Detection and Alarm: Fire alarm system conductors and cables.
- G. Section 31 2316 - Excavation.
- H. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.
- I. Section 31 2323 - Fill: Bedding and backfilling.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.05 FIELD CONDITIONS

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Strategic Energy Solutions, Inc. and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- D. Comply with NEMA WC 70.
- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- G. Conductor Material:
 - 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
 - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B 787M unless otherwise indicated.
 - 3. Tinned Copper Conductors: Comply with ASTM B33.
- H. Minimum Conductor Size:
 - 1. Branch Circuits: 12 AWG.
 - a. Exceptions:
 - 1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
 - 2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
 - 3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
- I. Conductor Color Coding:
 - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 - 2. Color Coding Method: Integrally colored insulation.
 - 3. Color Code:
 - a. 208Y/120 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral/Grounded: White.
 - b. Equipment Ground, All Systems: Green.

2.03 SINGLE CONDUCTOR BUILDING WIRE

- A. Manufacturers:
 - 1. Copper Building Wire:
- B. Description: Single conductor insulated wire.
- C. Conductor Stranding:
 - 1. Feeders and Branch Circuits:
 - a. Size 10 AWG and Smaller: Solid.
 - b. Size 8 AWG and Larger: Stranded.
 - 2. Control Circuits: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation:
 - 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
 - a. Size 4 AWG and Larger: Type XHHW-2.
 - b. Installed Underground: Type XHHW-2.

- c. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.

2.04 NONMETALLIC-SHEATHED CABLE

- A. Description: NFPA 70, Type NM multiple-conductor cable listed and labeled as complying with UL 719, Type NM-B.
- B. Conductor Stranding:
 1. Size 10 AWG and Smaller: Solid.
 2. Size 8 AWG and Larger: Stranded.
- C. Insulation Voltage Rating: 600 V.

2.05 UNDERGROUND FEEDER AND BRANCH-CIRCUIT CABLE

- A. Description: NFPA 70, Type UF multiple-conductor cable listed and labeled as complying with UL 493, Type UF-B.
- B. Provide equipment grounding conductor unless otherwise indicated.
- C. Conductor Stranding:
 1. Size 10 AWG and Smaller: Solid.
 2. Size 8 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.

2.06 SERVICE ENTRANCE CABLE

- A. Manufacturers:
 1. Copper Service Entrance Cable:
 - a. Cerro Wire LLC: www.cerrowire.com.
 - b. Encore Wire Corporation: www.encorewire.com.
 - c. Southwire Company: www.southwire.com.
- B. Service Entrance Cable for Underground Use: NFPA 70, Type USE single-conductor cable listed and labeled as complying with UL 854, Type USE-2, and with UL 44, Type RHH/RHW-2.
- C. Conductor Stranding: Stranded.
- D. Insulation Voltage Rating: 600 V.

2.07 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Wiring Connectors for Splices and Taps:
 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
 2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
- C. Wiring Connectors for Terminations:
 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
 2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
 3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
 4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
 5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.

- D. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
- E. Mechanical Connectors: Provide bolted type or set-screw type.
 - 1. Manufacturers:
 - a. Burndy LLC; _____: www.burndy.com.
 - b. Burndy: www.burndy.com.
 - c. IlSCO: www.ilSCO.com.
- F. Compression Connectors: Provide circumferential type or hex type crimp configuration.

2.08 WIRING ACCESSORIES

- A. Electrical Tape:
 - 1. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
- B. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
 - 1. Manufacturers:
 - a. 3M: www.3m.com.
 - b. American Polywater Corporation: www.polywater.com.
 - c. Ideal Industries, Inc: www.idealindustries.com.
- C. Cable Ties: Material and tensile strength rating suitable for application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that field measurements are as indicated.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

- A. Circuiting Requirements:
 - 1. Unless dimensioned, circuit routing indicated is diagrammatic.
 - 2. When circuit destination is indicated without specific routing, determine exact routing required.
 - 3. Arrange circuiting to minimize splices.
 - 4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
 - 5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
 - 6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
 - 7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
 - a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
 - b. Increase size of conductors as required to account for ampacity derating.

- c. Size raceways, boxes, etc. to accommodate conductors.
8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
 - a. Branch circuits fed from ground fault circuit interrupter (GFCI) circuit breakers.
 - b. Branch circuits fed from feed-through protection of GFI receptacles.
 - c. Branch circuits with dimming controls.
 - d. Branch circuits with isolated grounding conductor.
 - e. _____.
9. Provide oversized neutral/grounded conductors where indicated and as specified below.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Install nonmetallic-sheathed cable (Type NM-B) in accordance with NECA 121.
- E. Install underground feeder and branch-circuit cable (Type UF-B) in accordance with NECA 121.
- F. Installation in Raceway:
 1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
 2. Pull all conductors and cables together into raceway at same time.
 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- G. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- H. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
- I. Terminate cables using suitable fittings.
- J. Install conductors with a minimum of 12 inches of slack at each outlet.
- K. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.
- L. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- M. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- N. Make wiring connections using specified wiring connectors.
 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
 3. Do not remove conductor strands to facilitate insertion into connector.
 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
 5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

- O. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
- P. Insulate ends of spare conductors using vinyl insulating electrical tape.
- Q. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- R. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

END OF SECTION

SECTION 26 0526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Notify Strategic Energy Solutions, Inc. of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.
- B. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- E. Grounding System Resistance:
 - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Strategic Energy Solutions, Inc.. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- F. Grounding Electrode System:
 - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
 - a. Provide continuous grounding electrode conductors without splice or joint.
 - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
- G. Service-Supplied System Grounding:
 - 1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
 - 2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.
- H. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:

1. Provide grounding electrode system for each separate building or structure.
 2. Provide equipment grounding conductor routed with supply conductors.
 3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
 4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.
- I. Separately Derived System Grounding:
1. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
 2. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
 3. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
 4. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.
- J. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
 2. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
 3. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
 4. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
 5. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
- K. Communications Systems Grounding and Bonding:
1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
 2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
 - a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
 - b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.
 - c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.

2.02 GROUNDING AND BONDING COMPONENTS

- A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
 2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:
1. Use insulated copper conductors unless otherwise indicated.
 - a. Exceptions:
 - 1) Use bare copper conductors where installed underground in direct contact with earth.

- 2) Use bare copper conductors where directly encased in concrete (not in raceway).
- C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
 3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
- D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
 2. Size: As indicated.
 3. Holes for Connections: As indicated or as required for connections to be made.

END OF SECTION

SECTION 26 0529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.02 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- C. MFMA-4 - Metal Framing Standards Publication; 2004.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - 5. Notify Strategic Energy Solutions, Inc. of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.
- C. ANSI/ TIA/ EIA 568 Commercial Building Telecommunications Cabling Standard, current revision level.
- D. ANSI/ TIA/ EIA 569 Commercial Building Standard for Telecommunications Pathways and Spaces, current revision level.
- E. ANSI/ TIA/ EIA 568 Commercial Building Telecommunications Cabling Standard, current revision level.
- F. ANSI/ TIA/ EIA 569 Commercial Building Standard for Telecommunications Pathways and Spaces, current revision level.

1.04 SUMMARY

- A. ASTM A682 Standard Specification for Steel, Strip, High-Carbon, Cold-Rolled, Spring Quality.
- B. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, and services to completely execute the system of conduit hangers and supports as described in this specification.
- C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this project, with a minimum structural safety factor of five times the applied force.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.
- C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
- D. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.
- E. Installer's Qualifications: Include evidence of compliance with specified requirements.
- F. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with applicable building code.

1.07 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
 - 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
 - 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
 - 4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
 - 5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
 - 1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
 - 2. Conduit Clamps: Bolted type unless otherwise indicated.
 - 3. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com.
 - b. Erico International Corporation: www.erico.com.
 - c. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
 - d. Thomas & Betts Corporation: www.tnb.com.

- C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
 - 1. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com.
 - b. Erico International Corporation: www.erico.com.
 - c. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
 - d. Thomas & Betts Corporation: www.tnb.com.
 - e. _____.
- D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
 - 1. Comply with MFMA-4.
 - 2. Channel (Strut) Used as Raceway (only where specifically indicated): Listed and labeled as complying with UL 5B.
 - 3. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
 - b. Thomas & Betts Corporation: www.tnb.com.
 - c. Unistrut, a brand of Atkore International Inc: www.unistrut.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
 - e. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
- E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
 - 1. Minimum Size, Unless Otherwise Indicated or Required:
 - a. Equipment Supports: 1/2 inch diameter.
 - b. Single Conduit up to 1 inch (27mm) trade size: 1/4 inch diameter.
- F. Non-Penetrating Rooftop Supports for Low-Slope Roofs: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
 - 1. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
 - 2. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
 - 3. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
 - 4. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
 - b. Erico International Corporation: www.erico.com.
 - c. PHP Systems/Design: www.phpsd.com.
 - d. Unistrut, a brand of Atkore International Inc: www.unistrut.com.
- G. Anchors and Fasteners:
 - 1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
 - 2. Manufacturers - Powder-Actuated Fastening Systems:
 - a. Hilti, Inc: www.us.hilti.com.
 - b. ITW Ramset, a division of Illinois Tool Works, Inc: www.ramset.com.
 - c. Powers Fasteners, Inc: www.powers.com.
 - d. Simpson Strong-Tie Company Inc: www.strongtie.com.
- H. Power-Strut, Division of Allied Support Systems
- I. Hilti Corporation
- J. ERICO, International Corporation.

- K. Hangers, Supports, Anchors, and Fasteners - General: Protective zinc coating either Electro-Plated (ASTM B633 SCI or SC3), Pre-Galvanized (ASTM a525 coating designation G90) or Hot-Dip Galvanized after fabrication (ASTM A123). The minimum thickness of zinc coating shall be 0.2 mill (5 micrometers)..
- L. Provide materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
 - 1. Product: Pre-galvanized strut.
 - 2. Product: Hilti DX Series
- M. Conduit Hangers:
 - 1. Shall have a vertical load limit of 100 lbs, and a horizontal load limit of 25 lbs..
 - 2. Shall be available with either a plain hole for 1/4" bolt or a 1/4-20 thread impression.
 - 3. Shall be available for 3/8" through 2" EMT, rigid, and aluminum conduit.
 - 4. Shall be available pre-assembled with manufacturer's specialty fasteners for connection to building structures like beam, flange, drop wire/rod, wood structure, concrete and acoustical tee grid.
- N. Wire Rope Hangers:
 - 1. Wire rope hanger assemblies shall be made of galvanized steel.
 - 2. Hanger shall meet the fire rating requirements for DIN 4102-2 for 30 minutes at 30 percent of rated load.
 - 3. Rope hangers shall have a minimum safety factor of 5:1.
 - 4. Rope hangers are not permitted to support conduits.
 - 5. Rope hangers are permitted to hang light fixtures, were applicable.
 - 6. Hangers shall be fully adjustable.
 - 7. Manufacturer of wire rope hangers shall be:
 - a. ERICO, INC., Speed Link series.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install support and attachment components in a neat and workmanlike manner in accordance with NECA 1.
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- D. Unless specifically indicated or approved by Strategic Energy Solutions, Inc., do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by Strategic Energy Solutions, Inc., do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Equipment Support and Attachment:
 - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- H. Secure fasteners according to manufacturer's recommended torque settings.

- I. Remove temporary supports.

END OF SECTION

**SECTION 26 0534
CONDUIT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Aluminum rigid metal conduit (RMC).
- C. Intermediate metal conduit (IMC).
- D. Flexible metal conduit (FMC).
- E. Liquidtight flexible metal conduit (LFMC).
- F. Electrical metallic tubing (EMT).
- G. Rigid polyvinyl chloride (PVC) conduit.
- H. Electrical nonmetallic tubing (ENT).
- I. Conduit fittings.
- J. Conduit, fittings and conduit bodies.

1.02 RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping.
- B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- C. Section 26 0529 - Hangers and Supports for Electrical Systems.
- D. Section 26 0553 - Identification for Electrical Systems.
- E. Section 26 0537 - Boxes.
- F. Section 27 1005 - Structured Cabling for Voice and Data - Inside-Plant: Additional requirements for communications systems conduits.

1.03 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.
- B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.
- C. ANSI C80.5 - American National Standard for Electrical Rigid Aluminum Conduit (ERAC); 2005.
- D. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC); 2005.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- F. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.
- G. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit; 2004.
- H. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2003.
- I. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.
- J. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2013.
- K. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2015.
- L. NEMA TC 13 - Electrical Nonmetallic Tubing (ENT); 2014.
- M. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- N. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
- O. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

- P. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel; Current Edition, Including All Revisions.
- Q. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.
- R. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
- S. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
- T. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.
- U. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.
- V. UL 1653 - Electrical Nonmetallic Tubing; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
 - 4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
 - 5. Notify Strategic Energy Solutions, Inc. of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.
- C. Shop Drawings:
 - 1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
 - 2. Include proposed locations of roof penetrations and proposed methods for sealing.
- D. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch (53 mm) trade size and larger.
- E. Product Data: Provide for metallic conduit, flexible metal conduit, liquidtight flexible metal conduit, metallic tubing, nonmetallic conduit, flexible nonmetallic conduit, nonmetallic tubing, fittings, and conduit bodies.
- F. Project Record Documents: Accurately record actual routing of conduits larger than 2 inches.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.
- B. Accept conduit on site. Inspect for damage.

- C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- D. Protect PVC conduit from sunlight.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:
 - 1. Under Slab on Grade: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
 - 2. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.
- D. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- E. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- F. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- G. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- H. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- I. Exposed, Exterior: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit.
- J. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- K. Corrosive Locations Above Ground: Use PVC-coated galvanized steel rigid metal conduit or aluminum rigid metal conduit.
- L. Hazardous (Classified) Locations: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), aluminum rigid metal conduit, or PVC-coated galvanized steel rigid metal conduit.

2.02 CONDUIT REQUIREMENTS

- A. Communications Systems Conduits: Also comply with Section 27 1005.
- B. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

B. Fittings:

1. **Manufacturers:**
 - a. Bridgeport Fittings Inc: www.bptfittings.com.
 - b. O-Z/Gedney, a brand of Emerson Industrial Automation:
www.emersonindustrial.com.
 - c. Thomas & Betts Corporation: www.tnb.com.
2. **Non-Hazardous Locations:** Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. **Hazardous (Classified) Locations:** Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
4. **Material:** Use steel or malleable iron.
5. **Connectors and Couplings:** Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 ALUMINUM RIGID METAL CONDUIT (RMC)

A. Manufacturers:

1. Allied Tube & Conduit: www.alliedeg.com.
2. Republic Conduit: www.republic-conduit.com.
3. Wheatland Tube Company: www.wheatland.com.

B. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.

C. Fittings:

1. **Manufacturers:**
 - a. Bridgeport Fittings Inc: www.bptfittings.com.
 - b. O-Z/Gedney, a brand of Emerson Industrial Automation:
www.emersonindustrial.com.
 - c. Thomas & Betts Corporation: www.tnb.com.
2. **Non-Hazardous Locations:** Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. **Hazardous (Classified) Locations:** Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
4. **Material:** Use aluminum.
5. **Connectors and Couplings:** Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.05 INTERMEDIATE METAL CONDUIT (IMC)

A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

B. Fittings:

1. **Non-Hazardous Locations:** Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. **Hazardous (Classified) Locations:** Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
3. **Material:** Use steel or malleable iron.
4. **Connectors and Couplings:** Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.06 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:

1. AFC Cable Systems, Inc: www.afcweb.com.
2. Electri-Flex Company: www.electriflex.com.
3. International Metal Hose: www.metalhose.com.

- B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.
- C. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.
- D. Description: Interlocked steel construction.
- E. Fittings: NEMA FB 1.

2.07 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- B. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.

2.08 ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
 - 1. Allied Tube & Conduit: www.alliedeg.com.
 - 2. Beck Manufacturing, Inc: www.beckmfg.com.
 - 3. Wheatland Tube Company: www.wheatland.com.
- B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- C. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.
 - 3. Connectors and Couplings: Use compression (gland) or set-screw type.
 - a. Do not use indenter type connectors and couplings.
- D. Description: ANSI C80.3; galvanized tubing.
- E. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron compression type.

2.09 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- B. Fittings:
 - 1. Manufacturer: Same as manufacturer of conduit to be connected.
 - 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.10 ELECTRICAL NONMETALLIC TUBING (ENT)

- A. Manufacturers:
 - 1. Beck Manufacturing, Inc: www.beckmfg.com.
 - 2. Cantex Inc: www.cantexinc.com.
 - 3. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com.
- B. Description: NFPA 70, Type ENT electrical nonmetallic tubing complying with NEMA TC 13 and listed and labeled as complying with UL 1653.
- C. Fittings:

1. Manufacturer: Same as manufacturer of ENT to be connected.
2. Use solvent-welded type fittings.
3. Solvent-Welded Fittings: Rigid PVC fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; suitable for use with ENT.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on drawings.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.
- D. Verify routing and termination locations of conduit prior to rough-in.
- E. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit in a neat and workmanlike manner in accordance with NECA 1.
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.
- E. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- F. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- G. Install electrical nonmetallic tubing (ENT) in accordance with NECA 111.
- H. Conduit Support:
 1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- I. Connections and Terminations:
 1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
 2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
 3. Use suitable adapters where required to transition from one type of conduit to another.
 4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
 5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
 6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
 7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
- J. Penetrations:
 1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
 2. Make penetrations perpendicular to surfaces unless otherwise indicated.
 3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
 4. Conceal bends for conduit risers emerging above ground.
 5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.

6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
 7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
 8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- K. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
 2. Where conduits are subject to earth movement by settlement or frost.
- L. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
 2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- M. Provide grounding and bonding in accordance with Section 26 0526.

END OF SECTION

**SECTION 26 0535
SURFACE RACEWAYS**

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 0529 - Hangers and Supports for Electrical Systems.
 - 1. Includes metal channel (strut) used as raceway.
- C. Section 26 0534 - Conduit.
- D. Section 26 0537 - Boxes.
- E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 2726 - Wiring Devices: Receptacles.

1.02 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- D. NEMA PRP 5 - Installation Guidelines for Surface Nonmetallic Raceway; 2015.
- E. UL 5 - Surface Metal Raceways and Fittings; Current Edition, Including All Revisions.
- F. UL 5A - Nonmetallic Surface Raceways and Fittings; Current Edition, Including All Revisions.
- G. UL 111 - Outline of Investigation for Multioutlet Assemblies; Current Edition, Including All Revisions.
- H. UL 870 - Wireways, Auxiliary Gutters, and Associated Fittings; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of raceways with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate rough-in locations of outlet boxes provided under Section 26 0537 and conduit provided under Section 26 0534 as required for installation of raceways provided under this section.
 - 3. Verify minimum sizes of raceways with the actual conductors and components to be installed.
 - 4. Notify Strategic Energy Solutions, Inc. of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install raceways until final surface finishes and painting are complete.
 - 2. Do not begin installation of conductors and cables until installation of raceways is complete between outlet, junction and splicing points.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including dimensions, knockout sizes and locations, materials, fabrication details, finishes, service condition requirements, and accessories.
 - 1. Surface Raceway Systems: Include information on fill capacities for conductors and cables.

- C. Shop Drawings:
 - 1. Pre-wired Surface Raceway Systems: Provide plan and elevation views including dimensioned locations of wiring devices and circuiting arrangements.
 - 2. Wireways: Provide dimensioned plan and elevation views including adjacent equipment with all required clearances indicated.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 RACEWAY REQUIREMENTS

- A. Provide all components, fittings, supports, and accessories required for a complete raceway system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

2.02 SURFACE RACEWAY SYSTEMS

- A. Manufacturers:
 - 1. Hubbell Incorporated: www.hubbell-wiring.com.
 - 2. MonoSystems, Inc: www.monosystems.com.
 - 3. Wiremold, a brand of Legrand North America, Inc: www.legrand.us.
- B. Surface Metal Raceways: Listed and labeled as complying with UL 5.
- C. Surface Nonmetallic Raceways: Listed and labeled as complying with UL 5A.
- D. Multioutlet Assemblies: Listed and labeled as complying with UL 111.
- E. Metal Channel (Strut) Used as Raceway: Comply with Section 26 0529.
- F. Surface Raceway System:
 - 1. Color: To be selected by Architect.
 - 2. Accessory Device Boxes: Suitable for the devices to be installed; color to match raceway.
 - 3. Integrated Device Provisions:
 - a. Receptacles:
 - 1) Comply with Section 26 2726, except for finishes.
 - 2) Color: Match raceway.
 - 3) Spacing: As indicated on the drawings.
 - b. Communications Outlets:
 - 1) Voice and Data Jacks: Include provisions for jacks furnished by others.

2.03 WIREWAYS

- A. Manufacturers:
 - 1. Cooper B-Line, a division of Cooper Industries: www.cooperindustries.com.
- B. Description: Lay-in wireways and wiring troughs with removable covers; listed and labeled as complying with UL 870.
- C. Wireway Type, Unless Otherwise Indicated:
 - 1. Indoor Clean, Dry Locations: NEMA 250, Type 1, painted steel with screw-cover.
- D. Finish for Painted Steel Wireways: Manufacturer's standard grey unless otherwise indicated.
- E. Where wireway size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.

- B. Verify that outlet boxes and conduit terminations are installed in proper locations and are properly sized in accordance with NFPA 70 to accommodate raceways.
- C. Verify that mounting surfaces are ready to receive raceways and that final surface finishes are complete, including painting.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install raceways in a neat and workmanlike manner in accordance with NECA 1.
- C. Install raceways plumb and level.
- D. Arrange wireways and associated raceway connections to comply with NFPA 70, including but not limited to requirements for deflected conductors and wireways used as pullboxes. Increase size of wireway where necessary.
- E. Secure and support raceways in accordance with Section 26 0529 at intervals complying with NFPA 70 and manufacturer's requirements.
- F. Close unused raceway openings.
- G. Provide grounding and bonding in accordance with Section 26 0526.
- H. Identify raceways in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect raceways for damage and defects.
- C. Surface Raceway Systems with Integrated Devices: Test each wiring device to verify operation and proper polarity.
- D. Correct wiring deficiencies and replace damaged or defective raceways.

3.04 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 PROTECTION

- A. Protect installed raceways from subsequent construction operations.

END OF SECTION

SECTION 26 0537
BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

1.02 RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping.
- B. Section 26 0529 - Hangers and Supports for Electrical Systems.
- C. Section 26 0535 - Surface Raceways:
 - 1. Accessory boxes designed specifically for surface raceway systems.
 - 2. Lay-in wireways and wiring troughs with removable covers.
- D. Section 26 2726 - Wiring Devices:
 - 1. Wall plates.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
- C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.
- D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.
- E. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013.
- F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. SCTE 77 - Specification for Underground Enclosure Integrity; 2013.
- I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- K. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.
- L. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
 - 4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
 - 5. Coordinate the work with other trades to preserve insulation integrity.
 - 6. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.

7. Notify Strategic Energy Solutions, Inc. of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.
 1. Underground Boxes/Enclosures: Include reports for load testing in accordance with SCTE 77 certified by a professional engineer or an independent testing agency upon request.
- C. Samples:
 1. Floor Boxes: Provide one sample(s) of each floor box proposed for substitution upon request.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. See Section 01 6000 - Product Requirements, for additional provisions.
 2. Keys for Lockable Enclosures: Two of each different key.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 BOXES

- A. General Requirements:
 1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
 3. Provide products listed, classified, and labeled as suitable for the purpose intended.
 4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
 5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
 1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
 2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
 3. Use suitable concrete type boxes where flush-mounted in concrete.
 4. Use suitable masonry type boxes where flush-mounted in masonry walls.
 5. Use raised covers suitable for the type of wall construction and device configuration where required.
 6. Use shallow boxes where required by the type of wall construction.
 7. Do not use "through-wall" boxes designed for access from both sides of wall.
 8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
 9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.

10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
 11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
 12. Wall Plates: Comply with Section 26 2726.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
 2. NEMA 250 Environment Type, Unless Otherwise Indicated:
 3. Junction and Pull Boxes Larger Than 100 cubic inches:
 - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
- D. The Wiremold Company: www.wiremold.com.
- E. Thomas & Betts Corporation.
- F. Raco. A Hubbell Company.
1. Minimum size for communications, fire alarm, sound system and security system rough-ins shall be 4" square, 3-1/2" deep unless otherwise noted.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on drawings.
- B. Verify that mounting surfaces are ready to receive boxes.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Box Supports:
 1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
 2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
 3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
- E. Install boxes plumb and level.
- F. Flush-Mounted Boxes:
 1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

- G. Install boxes as required to preserve insulation integrity.
- H. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- I. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- J. Close unused box openings.
- K. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- L. Provide grounding and bonding in accordance with Section 26 0526.

3.03 CLEANING

- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 26 0923
LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Digital Wall Box time switches.
- B. Outdoor Photoelectric switches.
- C. Occupancy sensors.
- D. Lighting contactors

1.02 RELATED REQUIREMENTS

- A. Section 26 09 43 - Network Lighting Controls.
- B. Section 26 2726 - Wiring Devices for wall-box dimmers and line voltage light switches.
- C. Section 01 6000 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.
- D. Section 01 7000 - Execution Requirements: Examination, preparation, and general installation procedures; preinstallation meetings; cutting and patching; cleaning and protection; starting of systems; demonstration and instruction; closeout procedures except payment procedures; requirements for alterations work.
- E. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance (O&M) data, warranties and bonds.
- F. Section 01 7900 - Demonstration and Training: Detailed requirements.

1.03 REFERENCE STANDARDS

- A. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2008.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product data: For each type of product indicated.
- C. Shop Drawings: Show installation details for occupancy and light-level sensors.
 - 1. Interconnection diagrams showing field installed wiring.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE

- A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in LOCATION.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a One year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 DIGITAL WALL BOX TIME SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Intermatic, Inc.
 - 2. Leviton Manufacturing Co., Inc.
 - 3. TORK.
 - 4. Watt Stopper
 - 5. Lithonia Lighting, Inc.
 - 6. Lightolier Controls; a Philips Company
- B. Electronic, Solid-state programmable units with alphanumeric display.
- C. Time-out setting range from 5 minutes to 12 hours.
- D. Electroluminescent back-lit LCD shows time countdown.
- E. Blink warn 1 minute prior to time-out.
- F. 120/230/277 VAC, 60 Hz.
- G. 0-1200W electronic ballast load rating.

2.02 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Manufacturers: Subject to compliance with requirements, outdoor photoelectric switches shall be provided by the manufacturer of the light fixture or by the manufacturer of the lighting control panel.
 - 1. Light level monitoring range: 0 to 200 fc.
 - 2. Operating temperature: -40 degrees F to 140 degrees F.
 - 3. Time delay: Programmable at the lighting control panel.
 - 4. Mounting: 1/2" threaded conduit fitting.
 - 5. Housing: Weatherproof, UV-stabilizing plastic, with hooded lens.

2.03 OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, occupancy sensors shall be provided by the manufacturer of the light fixture or by the manufacturer of the lighting control panel.
- B. General Description: Wall-or ceiling mounting, solid state units with separate relay unit.
 - 1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, manually adjustable for a minimum range of 1 to 30 minutes. Set all sensors to a fixed 20-minute time delay.
 - 2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 - 3. Relay unit: Dry contacts rated for 20A ballast load at 120 and 277 V ac, for 13A tungsten at 120 Vac, and for 1 hp at 120 Vac. Power supply to sensor shall be 24 V dc, 150 mA, class 2 power source as defined by NFPA 70.
 - 4. Indicator: LED's to show when motion is being detected during testing and normal operation of the sensor.
 - 5. Bypass Switch: Override the on function in case of sensor failure.
- C. Dual-Technology Type: Ceiling or wall mounted as indicated; detect occupancy by using a combination of PIR (Passive Infrared) and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on/off functions shall be selectable in the field by operating controls on the unit.
 - 1. Sensor specifications: Exact motion coverage area, sensor style and mounting type shall be selected by manufacturer to insure proper operation. manufacturer shall submit floor plans showing sensor location, quantity and style for approval.

2.04 LIGHTING CONTACTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D; Schneider Electric.
 - 2. Eaton Electrical Inc.; Cutler Hammer Products.
 - 3. Watt Stopper
 - 4. GE Industrial Systems.
- B. Description: Electrically operated and electrically held, combination type with non-fused disconnect, complying with NEMA ICS 2 and UL 508.
 - 1. Current rating for switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-in rush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
 - 2. fault current withstand rating: Equal to or exceeding the available fault current at the point of installation.
 - 3. Provide with control and pilot devices as indicated on drawings, matching the NEMA type specified for the enclosure.

PART 3 EXECUTION

3.01 SENSOR INSTALLATION

- A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.02 WIRING INSTALLTION

- A. Wiring method: Comply with division 26 section " Low Voltage Electrical Power Conductors and Cables" Minimum conduit size shall be 1/2 inch.
- B. Wiring within enclosures: Comply with NECA 1. Seperate power-limited and non-power limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets, and equipment enclosures.

3.03 IDENTIFICATION

- A. Identify components, power and control wiring according to Division 26 Section " Identification for Electrical System."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.04 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of substantial completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to project during other-than normal occupancy hours for this purpose.

3.05 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing time switches and sensors, and after electrical circuiting has been energized, adjust and test for compliance with requirements.
 - 2. Operational test: Verify operation of each lighting control device, and adjust time delays.
- C. Lighting control devices that fail tests and inspections are defective and shall be replaced.

3.06 SYSTEM STARTUP

- A. Provide manufacturer's field representative to perform systems startup.
- B. Prepare and start equipment and systems in accordance with manufacturers' instructions and recommendations.
- C. Adjust for proper operation within manufacturer's published tolerances.

END OF SECTION

**SECTION 26 2416
PANELBOARDS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 0529 - Hangers and Supports for Electrical Systems.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 2813 - Fuses: Fuses for fusible switches and spare fuse cabinets.

1.03 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Federal Specification; Revision E, 2013.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2009.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- E. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.
- F. NEMA PB 1 - Panelboards; 2011.
- G. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; 2013.
- H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.
- I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- K. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- L. UL 67 - Panelboards; Current Edition, Including All Revisions.
- M. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.
- N. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.
- O. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.
- P. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.
- Q. UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Strategic Energy Solutions, Inc. of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
- F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. See Section 01 6000 - Product Requirements, for additional provisions.
 2. Panelboard Keys: Two of each different key.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

- A. Maintain ambient temperature within the following limits during and after installation of panelboards:
 1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Eaton Corporation: www.eaton.com.
- B. General Electric Company: www.geindustrial.com.
- C. Schneider Electric; Square D Products: www.schneider-electric.us.

D. Siemens Energy & Automation, Inc..

2.02 PANELBOARDS - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet.
 - 2. Ambient Temperature:
 - a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
- C. Short Circuit Current Rating:
 - 1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- G. Bussing: Sized in accordance with UL 67 temperature rise requirements.
 - 1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
 - 2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
- H. Conductor Terminations: Suitable for use with the conductors to be installed.
- I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - 2. Boxes: Galvanized steel unless otherwise indicated.
 - a. Provide wiring gutters sized to accommodate the conductors to be installed.
 - b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
 - 3. Fronts:
 - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
 - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
 - 4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

2.03 POWER DISTRIBUTION PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
 - 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
 - 1. Phase and Neutral Bus Material: Aluminum.
 - 2. Ground Bus Material: Aluminum.
- D. Circuit Breakers:

1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.
- E. Enclosures:
 1. Provide surface-mounted enclosures unless otherwise indicated.
 2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
 3. Provide clear plastic circuit directory holder mounted on inside of door.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
 2. Phase and Neutral Bus Material: Aluminum.
 3. Ground Bus Material: Aluminum.
- D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
- E. Enclosures:
 1. Provide surface-mounted or flush-mounted enclosures as indicated.
 2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
 3. Provide clear plastic circuit directory holder mounted on inside of door.

2.05 OVERCURRENT PROTECTIVE DEVICES

- A. Fusible Switches:
 1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
 2. Fuse Clips: As required to accept indicated fuses.
 3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
 4. Conductor Terminations:
 - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
- B. Molded Case Circuit Breakers:
 1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
 2. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 3. Conductor Terminations:
 - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
6. Provide the following circuit breaker types where indicated:
 - a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
 - b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
 - c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
 - d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required supports in accordance with Section 26 0529.
- F. Install panelboards plumb.
- G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.
- I. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.
- J. Provide grounding and bonding in accordance with Section 26 0526.
- K. Install all field-installed branch devices, components, and accessories.
- L. Provide fuses complying with Section 26 2813 for fusible switches as indicated.
- M. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.
- N. Provide filler plates to cover unused spaces in panelboards.
- O. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
 1. Emergency and night lighting circuits.
 2. Fire detection and alarm circuits.
 3. Communications equipment circuits.

3.02 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Perform inspection, testing, and adjusting in accordance with Section 01 4000.
- C. Inspect and test in accordance with NETA ATS, except Section 4.
- D. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- E. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1. Tests listed as optional are not required.

- F. Test GFCI circuit breakers to verify proper operation.
- G. Test AFCI circuit breakers to verify proper operation.
- H. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.03 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.
- C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.04 CLEANING

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 2701
ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metering transformer cabinets.
- B. Meter bases.

1.02 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SYSTEM DESCRIPTION

- A. System Characteristics: 208Y/120 volts, three phase, four-wire, 60 Hertz.
- B. Service Entrance:

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week prior to commencing work of this section. Review service entrance requirements and details with Utility Company representative.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide ratings and dimensions of transformer cabinets and meter bases.
- C. Submit utility company-prepared drawings.

1.06 QUALITY ASSURANCE

- A. Utility Company:
- B. Perform work in accordance with utility company written requirements and NFPA 70.
 - 1. Maintain one copy of each document on site.
- C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. GE Industrial: www.geindustrial.com.
- B. Milbank Manufacturing: www.milbankmfg.com.
- C. Square D: www.squared.com.

2.02 COMPONENTS

- A. Metering Transformer Cabinets: Sheet metal cabinet with hinged door, conforming to utility company requirements, with provisions for locking and sealing.
 - 1. Size: ____ inches x ____ inches x ____ inches.
 - 2. Size: As required by utility.
- B. Meter Base: Furnished by utility company.
- C. Other Components: As required by utility company.

PART 3 EXECUTION

3.01 PREPARATION

- A. Arrange with utility company to obtain permanent electric service to the Project.

- B. Verify that field measurements are as indicated on utility company drawings.

3.02 INSTALLATION

- A. Install service rack, weatherhead, metering transformer cabinets, and meter base as required by utility company.
- B. Install securely, in a neat and workmanlike manner, as specified in NECA 1.

END OF SECTION

**SECTION 26 2726
WIRING DEVICES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall switches.
- B. Wall dimmers.
- C. Receptacles.
- D. Wall plates.
- E. Floor box service fittings.

1.02 RELATED REQUIREMENTS

- A. Section 09 6900 - Access Flooring.
- B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- C. Section 26 0537 - Boxes.
- D. Section 26 0537 - Boxes.
- E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 2717 - Equipment Wiring: Cords and plugs for equipment.
- G. Section 26 0923 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors, in-wall time switches, and in-wall interval timers.

1.03 REFERENCE STANDARDS

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Federal Specification; Revision G, 2001.
- B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Federal Specification; Revision F, 1999.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
- E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).
- F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.
- I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.
- J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.
- K. UL 1310 - Class 2 Power Units; Current Edition, Including All Revisions.
- L. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
 - 3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.

4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
 5. Notify Strategic Energy Solutions, Inc. of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.
- B. Sequencing:
1. Do not install wiring devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
 1. Wall Dimmers: Include derating information for ganged multiple devices.
- C. Operation and Maintenance Data:
 1. Wall Dimmers: Include information on operation and setting of presets.
 2. GFCI Receptacles: Include information on status indicators.
 3. Surge Protection Receptacles: Include information on status indicators.
- D. Project Record Documents: Record actual installed locations of wiring devices.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hubbell Incorporated: www.hubbell-wiring.com.
- B. Leviton Manufacturing Company, Inc: www.leviton.com.
- C. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

2.02 WIRING DEVICE APPLICATIONS

- A. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- B. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
- C. Provide GFCI protection for receptacles installed in kitchens.
- D. Provide GFCI protection for receptacles serving electric drinking fountains.
- E. For flush floor service fittings, use tile rings for installations in tile floors.
- F. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

2.03 WIRING DEVICE FINISHES

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Wiring Devices, Unless Otherwise Indicated: White with white nylon wall plate.
- C. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.
- D. Flush Floor Box Service Fittings: Gray wiring devices with aluminum cover and ring/flange.
- E. Access Floor Boxes: Gray wiring devices with gray steel cover with insert to match floor covering.

2.04 ALL WIRING DEVICES

- A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.05 WALL SWITCHES

- A. Manufacturers:
 - 1. Hubbell Incorporated; _____: www.hubbell.com/#sle.
 - 2. Leviton Manufacturing Company, Inc: www.leviton.com.
 - 3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
- B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- C. Wall Switches: Heavy Duty, AC only general-use snap switch, complying with NEMA WD 6 and WD 1.
 - 1. Body and Handle: Ivory plastic with toggle handle.
 - 2. Ratings:
 - a. Voltage: 120 - 277 volts, AC.
 - b. Current: 20 amperes.

2.06 WALL DIMMERS

- A. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.
- B. Control: Slide control type with separate on/off switch.

2.07 RECEPTACLES

- A. Manufacturers:
 - 1. Hubbell Incorporated; _____: www.hubbell.com/#sle.
 - 2. Leviton Manufacturing Company, Inc: www.leviton.com.
 - 3. Lutron Electronics Company, Inc; Designer Style: www.lutron.com/sle.
 - 4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
- B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
 - 2. NEMA configurations specified are according to NEMA WD 6.
- C. USB Charging Devices:
 - 1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.
 - 2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port (Type A) USB charging device and receptacle, commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; rectangular decorator style.
 - 3. USB Charging Noncombination Devices: Four-port (Type A); rectangular decorator style.

2.08 WALL PLATES

- A. Manufacturers:
 - 1. Hubbell Incorporated: www.hubbell-wiring.com.
 - 2. Leviton Manufacturing Company, Inc: www.leviton.com.
- B. Wall Plates: Comply with UL 514D.
 - 1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
 - 2. Screws: Metal with slotted heads finished to match wall plate finish.

- C. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.
- D. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

2.09 FLOOR BOX SERVICE FITTINGS

- A. Manufacturers:
 - 1. Hubbell Incorporated; _____: www.hubbell.com/#sle.
 - 2. Thomas & Betts Corporation: www.tnb.com.
 - 3. Wiremold, a brand of Legrand North America, Inc: www.legrand.us
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: Service fittings compatible with floor boxes provided under Section 26 0537 with components, adapters, and trims required for complete installation.
- C. Flush Floor Service Fittings:
 - 1. Single Service Flush Convenience Receptacles:
 - a. Cover: Rectangular.
 - b. Configuration: One standard convenience duplex receptacle(s) with duplex flap opening(s).
 - 2. Single Service Flush Communications Outlets:
 - a. Cover: Rectangular.
 - b. Configuration: _____.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of wiring devices provided under this section.
 - 1. Mounting Heights: Unless otherwise indicated, as follows:
 - a. Wall Switches: 48 inches above finished floor.
 - b. Wall Dimmers: 48 inches above finished floor.
 - c. Fan Speed Controllers: 48 inches above finished floor.
 - d. Receptacles: 18 inches above finished floor or 6 inches above counter.
 - 2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.

3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
 4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Strategic Energy Solutions, Inc. to obtain direction prior to proceeding with work.
 5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.
- C. Install wiring devices in accordance with manufacturer's instructions.
 - D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
 - E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
 - F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
 - G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
 - H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
 - I. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.
 - J. Install wiring devices plumb and level with mounting yoke held rigidly in place.
 - K. Install wall switches with OFF position down.
 - L. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
 - M. Do not share neutral conductor on branch circuits utilizing wall dimmers.
 - N. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
 - O. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
 - P. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
 - Q. Identify wiring devices in accordance with Section 26 0553.
 - R. Install poke-through closure plugs in each unused core holes to maintain fire rating of floor.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Perform field inspection, testing, and adjusting in accordance with Section 01 4000.
- C. Inspect each wiring device for damage and defects.
- D. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.
- E. Test each receptacle to verify operation and proper polarity.
- F. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

- G. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Strategic Energy Solutions, Inc..

3.06 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

**SECTION 26 2813
FUSES**

PART 2 PRODUCTS

1.01 FUSES

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.
- C. Provide fuses of the same type, rating, and manufacturer within the same switch.
- D. Comply with UL 248-1.
- E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.

END OF SECTION

**SECTION 26 2818
ENCLOSED SWITCHES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 0529 - Hangers and Supports for Electrical Systems.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 2813 - Fuses.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- F. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- G. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 4. Notify Strategic Energy Solutions, Inc. of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
- D. Field Quality Control Test Reports.
- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Eaton Corporation: www.eaton.com.
- B. General Electric Company: www.geindustrial.com.
- C. Schneider Electric; Square D Products: www.schneider-electric.us.
- D. Siemens Industry, Inc: www.usa.siemens.com.

2.02 ENCLOSED SAFETY SWITCHES

- A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet.
 - 2. Ambient Temperature: Between -22 degrees F and 104 degrees F.
- D. Horsepower Rating: Suitable for connected load.
- E. Voltage Rating: Suitable for circuit voltage.
- F. Short Circuit Current Rating:
 - 1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- G. Provide with switch blade contact position that is visible when the cover is open.
- H. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
- I. Conductor Terminations: Suitable for use with the conductors to be installed.
- J. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
- K. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
- L. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- M. Heavy Duty Switches:
 - 1. Comply with NEMA KS 1.
 - 2. Conductor Terminations:
 - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed safety switches.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install enclosed switches in accordance with manufacturer's instructions.
- B. Install enclosed switches securely, in a neat and workmanlike manner in accordance with NECA 1.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required supports in accordance with Section 26 0529.
- E. Install enclosed switches plumb.
- F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.
- G. Provide grounding and bonding in accordance with Section 26 0526.
- H. Provide fuses complying with Section 26 2813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

- A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

**SECTION 26 2913
ENCLOSED CONTROLLERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Enclosed NEMA motor controllers for low-voltage (600 V and less) applications:
 - 1. Magnetic motor starters.
- B. Overcurrent protective devices for motor controllers, including overload relays.

1.02 RELATED REQUIREMENTS

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 0529 - Hangers and Supports for Electrical Systems.
- C. Section 26 0573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

1.03 REFERENCE STANDARDS

- A. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2008.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2000 (R2005), with errata, 2008.
- E. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; 2000 (R2010).
- F. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (R2011).
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.
- I. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules; Current Edition, Including All Revisions.
- J. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contractors and Motor-starters - Electromechanical Contractors and Motor-starters; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
 - 2. Coordinate the work to provide motor controllers and associated overload relays suitable for use with the actual motors to be installed.
 - 3. Coordinate the work to provide motor controllers and associated wiring suitable for interface with control devices to be installed.
 - 4. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 5. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 6. Notify Strategic Energy Solutions, Inc. of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.
- B. Shop Drawings: Indicate dimensions, voltage, controller sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Eaton Corporation: www.eaton.com.
- B. General Electric Company: www.geindustrial.com.
- C. Rockwell Automation, Inc.; Allen-Bradley Products: ab.rockwellautomation.com.
- D. Schneider Electric; Square D Products: www.schneider-electric.us.
- E. Siemens Industry, Inc: www.usa.siemens.com.

2.02 ENCLOSED MOTOR CONTROLLERS

- A. Provide enclosed motor controller assemblies consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Description: Enclosed motor controllers complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; ratings, configurations and features as indicated on the drawings.
- D. Service Conditions:
 - 1. Provide motor controllers and associated components suitable for operation under the following service conditions without derating:
 - a. Altitude:
 - 1) Class 1 Km Equipment (devices utilizing power semiconductors, e.g. variable frequency controllers): Less than 3,300 feet.
 - 2) Class 2 Km Equipment (electromagnetic and manual devices): Less than 6,600 feet.
 - b. Ambient Temperature: Between 32 degrees F and 104 degrees F.
 - 2. Provide motor controllers and associated components suitable for operation at indicated ratings under the service conditions at the installed location.
- E. Conductor Terminations: Suitable for use with the conductors to be installed.
- F. Enclosures:
 - 1. Comply with NEMA ICS 6.
 - 2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - 3. Finish: Manufacturer's standard unless otherwise indicated.
- G. Instrument Transformers:
 - 1. Comply with IEEE C57.13.
 - 2. Select suitable ratio, burden, and accuracy as required for connected devices.
 - 3. Current Transformers: Connect secondaries to shorting terminal blocks.
 - 4. Potential Transformers: Include primary and secondary fuses with disconnecting means.
- H. Magnetic Motor Starters: Combination type unless otherwise indicated.

1. Combination Magnetic Motor Starters: NEMA ICS 2, Class A combination motor controllers with magnetic contactor(s), externally operable disconnect and overload relay(s).
2. Configuration: Full-voltage non-reversing unless otherwise indicated.
3. Disconnects: Circuit breaker type.
 - a. Circuit Breakers: Motor circuit protectors (magnetic-only) unless otherwise indicated or required.
 - b. Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.
 - c. Provide auxiliary interlock for disconnection of external control power sources where applicable.
4. Overload Relays: Bimetallic thermal type unless otherwise indicated.

2.03 OVERCURRENT PROTECTIVE DEVICES

- A. Overload Relays:
 1. Provide overload relays and, where applicable, associated current elements/heaters, selected according to actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.
 2. Inverse-Time Trip Class Rating: Class 20 unless otherwise indicated or required.
 3. Trip-free operation.
 4. Visible trip indication.
 5. Resettable.
 - a. Employ manual reset unless otherwise indicated.
 - b. Do not employ automatic reset with two-wire control.
 6. Bimetallic Thermal Overload Relays:
 - a. Interchangeable current elements/heaters.
 - b. Adjustable trip; plus/minus 10 percent of nominal, minimum.
 - c. Trip test function.
- B. Circuit Breakers:
 1. Interrupting Capacity (not applicable to motor circuit protectors):
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 2. Motor Circuit Protectors:
 - a. Description: Instantaneous-trip circuit breakers furnished with magnetic instantaneous tripping elements for short circuit protection, but not with thermal inverse time tripping elements for overload protection; UL 489 recognized only for use as part of a listed combination motor controller with overload protection; ratings, configurations, and features as indicated on the drawings.
 - b. Provide field-adjustable magnetic instantaneous trip setting.

2.04 MOTOR CONTROL ACCESSORIES

- A. Auxiliary Contacts:
 1. Comply with NEMA ICS 5.
 2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each magnetic motor starter, minimum.
- B. Pilot Devices:
 1. Comply with NEMA ICS 5; heavy-duty type.
 2. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.

3. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.
 4. Indicating Lights: Push-to-test type unless otherwise indicated.
 5. Provide LED lamp source for indicating lights and illuminated devices.
- C. Control and Timing Relays:
1. Comply with NEMA ICS 5.
 2. Provide number and type of relays indicated or required to perform necessary functions.
- D. Control Power Transformers:
1. Size to accommodate burden of contactor coil(s) and all connected auxiliary devices.
 2. Include primary and secondary fuses.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install motor controllers in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment components in accordance with Section 26 0529.
- E. Install enclosed motor controllers plumb and level.
- F. Provide grounding and bonding in accordance with Section 26 0526.
- G. Install all field-installed devices, components, and accessories.
- H. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- I. Set field-adjustable motor controllers and associated components according to installed motor requirements, in accordance with manufacturer's recommendations and NFPA 70.
- J. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed in accordance with Section 26 0573.

END OF SECTION

**SECTION 26 3213
ENGINE GENERATORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Packaged engine generator system and associated components and accessories:
 - 1. Engine and engine accessory equipment.
 - 2. Alternator (generator).
 - 3. Generator set control system.
 - 4. Generator set enclosure.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 22 1005 - Plumbing Piping: Gas piping.
- C. Section 23 1123 - Facility Natural-Gas Piping.
- D. Section 23 5100 - Breechings, Chimneys, and Stacks: Engine exhaust piping.
- E. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- F. Section 26 0529 - Hangers and Supports for Electrical Systems.
- G. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- H. Section 26 3600 - Transfer Switches.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- B. NECA/EGSA 404 - Standard for Installing Generator Sets; 2014.
- C. NEMA MG 1 - Motors and Generators; 2014.
- D. NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines; 2015.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. NFPA 110 - Standard for Emergency and Standby Power Systems; 2013.
- G. UL 142 - Steel Aboveground Tanks for Flammable and Combustible Liquids; Current Edition, Including All Revisions.
- H. UL 1236 - Battery Chargers for Charging Engine-Starter Batteries; Current Edition, Including All Revisions.
- I. UL 2200 - Stationary Engine Generator Assemblies; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate compatibility of generator sets to be installed with work provided under other sections or by others.
 - a. Transfer Switches: See Section 26 3600.
 - 2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for engine generator system.
 - 3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 4. Coordinate the work to provide electrical circuits suitable for the power requirements of the actual auxiliary equipment and accessories to be installed.

5. Notify Strategic Energy Solutions, Inc. of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features. Include alternator starting capabilities, engine fuel consumption rates, and cooling, combustion air, and exhaust requirements.
 1. Include generator set sound level test data.
- C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.
- D. Specimen Warranty: Submit sample of manufacturer's warranty.
- E. Evidence of qualifications for installer.
- F. Evidence of qualifications for maintenance contractor (if different entity from installer).
- G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.
- H. Manufacturer's factory emissions certification.
- I. Manufacturer's certification that products meet or exceed specified requirements.
- J. Source quality control test reports.
- K. Provide NFPA 110 required documentation from manufacturer where requested by authorities having jurisdiction, including but not limited to:
 1. Certified prototype tests.
 2. Torsional vibration compatibility certification.
 3. NFPA 110 compliance certification.
 4. Certified rated load test at rated power factor.
- L. Manufacturer's detailed field testing procedures.
- M. Field quality control test reports.
- N. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
 1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.
- O. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- P. Maintenance contracts.
- Q. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.
- R. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. See Section 01 6000 - Product Requirements, for additional provisions.
 2. Extra Fuses: One of each type and size.

1.06 QUALITY ASSURANCE

- A. Comply with the following:
 1. NFPA 70 (National Electrical Code).
 2. NFPA 110 (Standard for Emergency and Standby Power Systems); meet requirements for Level 1 system.

3. NFPA 37 (Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines).
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with engine generator systems of similar size, type, and complexity; manufacturer's authorized installer.
- E. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.
- F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store generator sets in accordance with manufacturer's instructions and NECA/EGSA 404.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's instructions to avoid damage to generator set components, enclosure, and finish.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Packaged Engine Generator Set - Basis of Design: Generac Power Systems as indicated under product description below; www.generac.com/industrial.
- B. Packaged Engine Generator Set - Other Acceptable Manufacturers:
 1. Caterpillar Inc: www.cat.com.
 2. Generac Power Systems: www.generac.com/industrial.
 3. Kohler Co: www.kohlerpower.com.
- C. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.
- D. Source Limitations: Furnish engine generator sets and associated components and accessories produced by a single manufacturer and obtained from a single supplier.

2.02 PACKAGED ENGINE GENERATOR SYSTEM

- A. Provide new engine generator system consisting of all required equipment, sensors, conduit, boxes, wiring, piping, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. System Description:
 - 1. Application: Emergency/standby.
 - 2. Configuration: Single packaged engine generator set operated independently (not in parallel).
 - 3. Total System Power Rating: As indicated on drawings, standby.
- D. Generator Set General Requirements:
 - 1. Prototype tested in accordance with NFPA 110 for Level 1 systems.
 - 2. Factory-assembled, with components mounted on suitable base.
 - 3. List and label engine generator assembly as complying with UL 2200.
 - 4. Power Factor: Unless otherwise indicated, specified power ratings are at 0.8 power factor for three phase voltages and 1.0 power factor for single phase voltages.
 - 5. Provide suitable guards to protect personnel from accidental contact with rotating parts, hot piping, and other potential sources of injury.
 - 6. Main Line Circuit Breakers: Provide factory-installed line side connections with suitable lugs for load side connections.
- E. Service Conditions: Provide engine generator system and associated components suitable for operation under the service conditions at the installed location.
- F. Starting and Load Acceptance Requirements:
 - 1. Cranking Method: Cycle cranking complying with NFPA 110 (15 second crank period, followed by 15 second rest period, with cranking limiter time-out after 3 cycles), unless otherwise required.
 - 2. Cranking Limiter Time-Out: If generator set fails to start after specified cranking period, indicate overcrank alarm condition and lock-out generator set from further cranking until manually reset.
 - 3. Start Time: Capable of starting and achieving conditions necessary for load acceptance within 10 seconds (NFPA 110, Type 10).
 - 4. Maximum Load Step: Supports 100 percent of rated load in one step.
- G. Exhaust Emissions Requirements:
 - 1. Comply with federal (EPA), state, and local regulations applicable at the time of commissioning; include factory emissions certification with submittals.
 - 2. Do not make modifications affecting generator set factory emissions certification without approval of manufacturer and Engineer. Where such modifications are made, provide field emissions testing as necessary for certification.

2.03 ALTERNATOR (GENERATOR)

- A. Alternator: 4-pole, 1800 rpm (60 Hz output) revolving field, synchronous generator complying with NEMA MG 1; connected to engine with flexible coupling; voltage output configuration as indicated, with reconnectable leads for 3 phase alternators.
- B. Exciter:
 - 1. Exciter Type: Brushless; provide permanent magnet generator (PMG) excitation system; self-excited (shunt) systems are not permitted.
 - 2. PMG Excitation Short-Circuit Current Support: Capable of sustaining 300 percent of rated output current for 10 seconds.
 - 3. Voltage Regulation (with PMG excitation): Plus/minus 0.5 percent for any constant load from no load to full load.
- C. Temperature Rise: Comply with UL 2200.
- D. Insulation System: NEMA MG 1, Class H; suitable for alternator temperature rise.
- E. Enclosure: NEMA MG 1, drip-proof.
- F. Total Harmonic Distortion: Not greater than five percent.

- G. Alternator Heater: Provide strip heater to prevent moisture condensation on alternator windings.

2.04 GENERATOR SET CONTROL SYSTEM

- A. Provide microprocessor-based control system for automatic control, monitoring, and protection of generator set. Include sensors, wiring, and connections necessary for functions/indications specified.
- B. Control Panel:
1. Control Panel Mounting: Unit-mounted unless otherwise indicated; vibration isolated.
 2. Generator Set Control Functions:
 - a. Automatic Mode: Initiates generator set start/shutdown upon receiving corresponding signal from remote device (e.g. automatic transfer switch).
 - b. Manual Mode: Initiates generator set start/shutdown upon direction from operator.
 - c. Reset Mode: Clears all faults, allowing generator set restart after a shutdown.
 - d. Emergency Stop: Immediately shuts down generator set (without time delay) and prevents automatic restarting until manually reset.
 - e. Cycle Cranking: Programmable crank time, rest time, and number of cycles.
 - f. Time Delay: Programmable for shutdown (engine cooldown) and start (engine warmup).
 - g. Voltage Adjustment: Adjustable through range of plus/minus 5 percent.
 3. Generator Set Status Indications:
 - a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
 - b. Current (Amps): For each phase.
 - c. Frequency (Hz).
 - d. Real power (W/kW).
 - e. Reactive power (VAR/kVAR).
 - f. Apparent power (VA/kVA).
 - g. Power factor.
 - h. Duty Level: Actual load as percentage of rated power.
 - i. Engine speed (RPM).
 - j. Battery voltage (Volts DC).
 - k. Engine oil pressure.
 - l. Engine coolant temperature.
 - m. Engine run time.
 - n. Generator powering load (position signal from transfer switch).
 4. Generator Set Protection and Warning/Shutdown Indications:
 - a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following protections/indications:
 - 1) Overcrank (shutdown).
 - 2) Low coolant temperature (warning).
 - 3) High coolant temperature (warning).
 - 4) High coolant temperature (shutdown).
 - 5) Low oil pressure (shutdown).
 - 6) Overspeed (shutdown).
 - 7) Low fuel level (warning).
 - 8) Low coolant level (warning/shutdown).
 - 9) Generator control not in automatic mode (warning).
 - 10) High battery voltage (warning).
 - 11) Low cranking voltage (warning).
 - 12) Low battery voltage (warning).
 - 13) Battery charger failure (warning).
 - b. In addition to NFPA 110 requirements, provide the following protections/indications:
 - 1) High AC voltage (shutdown).
 - 2) Low AC voltage (shutdown).

- 3) High frequency (shutdown).
- 4) Low frequency (shutdown).
- 5) Overcurrent (shutdown).
- c. Provide contacts for local and remote common alarm.
- d. Provide lamp test function that illuminates all indicator lamps.
5. Other Control Panel Features:
 - a. Event log.
- C. Remote Annunciator:
 1. Remote Annunciator Mounting: Wall-mounted; Provide flush-mounted annunciator for finished areas and surface-mounted annunciator for non-finished areas unless otherwise indicated.
 2. Generator Set Status Indications:
 - a. Generator powering load (via position signal from transfer switch).
 - b. Communication functional.
 3. Generator Set Warning/Shutdown Indications:
 - a. Comply with NFPA 110 for Level 1 systems including but not limited to the following indications:
 - 1) Overcrank (shutdown).
 - 2) Low coolant temperature (warning).
 - 3) High coolant temperature (warning).
 - 4) High coolant temperature (shutdown).
 - 5) Low oil pressure (shutdown).
 - 6) Overspeed (shutdown).
 - 7) Low fuel level (warning).
 - 8) Low coolant level (warning/shutdown).
 - 9) Generator control not in automatic mode (warning).
 - 10) High battery voltage (warning).
 - 11) Low cranking voltage (warning).
 - 12) Low battery voltage (warning).
 - 13) Battery charger failure (warning).
 - b. Provide audible alarm with silence function.
 - c. Provide lamp test function that illuminates all indicator lamps.
- D. Remote Emergency Stop: Provide approved red, mushroom style remote emergency stop button where indicated or required by authorities having jurisdiction.

2.05 GENERATOR SET ENCLOSURE

- A. Enclosure Type: Sound attenuating, weather protective.
- B. Enclosure Material: Steel or aluminum.
- C. Hardware Material: Stainless steel.
- D. Color: Manufacturer's standard.
- E. Access Doors: Lockable, with all locks keyed alike.
- F. Openings: Designed to prevent bird/rodent entry.
- G. External Drains: Extend oil and coolant drain lines to exterior of enclosure for maintenance service.
- H. Sound Attenuating Enclosures: Line enclosure with non-hydroscopic, self-extinguishing sound-attenuating material.
- I. Utilize an upward discharging radiator hood.
- J. Exhaust Silencers: Where exhaust silencers are mounted within enclosure in main engine compartment, insulate silencer to minimize heat dissipation as necessary for operation at rated load under worst case ambient temperature.

- K. Enclosure Space Heater: Provide thermostatically controlled enclosure space heater to prevent condensation and improve starting under cold ambient conditions; size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that the ratings and configurations of generator sets and auxiliary equipment are consistent with the indicated requirements.
- C. Verify that rough-ins for field connections are in the proper locations.
- D. Verify that mounting surfaces are ready to receive equipment.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1.
- B. Install products in accordance with manufacturer's instructions.
- C. Install generator sets and associated accessories in accordance with NECA/EGSA 404.
- D. Arrange equipment to provide minimum clearances and required maintenance access.
- E. Unless otherwise indicated, mount generator set on properly sized 6 inch high concrete pad constructed in accordance with Section 03 3000. Provide suitable vibration isolators, where not factory installed.
- F. Provide required support and attachment in accordance with Section 26 0529.
- G. Use manufacturer's recommended oil and coolant, suitable for the worst case ambient temperatures.
- H. Provide natural gas piping in accordance with Section 23 1123.
- I. Provide engine exhaust piping in accordance with Section 23 5100, where not factory installed.
 - 1. Include piping expansion joints, piping insulation, thimble, condensation trap/drain, rain cap, hangers/supports, etc. as indicated or as required.
 - 2. Do not exceed manufacturer's maximum back pressure requirements.
- J. Provide grounding and bonding in accordance with Section 26 0526.
- K. Identify system wiring and components in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Provide services of a manufacturer's authorized representative to prepare and start systems and perform inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.
- C. Notify Owner and Strategic Energy Solutions, Inc. at least two weeks prior to scheduled inspections and tests.
- D. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- E. Provide all equipment, tools, and supplies required to accomplish inspection and testing, including load bank and fuel.
- F. Preliminary inspection and testing to include, at a minimum:
 - 1. Inspect each system component for damage and defects.
 - 2. Verify tightness of mechanical and electrical connections are according to manufacturer's recommended torque settings.

3. Check for proper oil and coolant levels.
- G. Prepare and start system in accordance with manufacturer's instructions.
- H. Perform acceptance test in accordance with NFPA 110.
- I. Provide field emissions testing where necessary for certification.
- J. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.04 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.
- D. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 2. Instructor: Manufacturer's authorized representative.
 3. Location: At project site.

3.06 PROTECTION

- A. Protect installed engine generator system from subsequent construction operations.

3.07 MAINTENANCE

- A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
- B. Provide to Owner a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of engine generator system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with a detailed schedule.
- C. Conduct site visit at least once every three months to perform inspection, testing, and preventive maintenance. Submit report to Owner indicating maintenance performed along with evaluations and recommendations.
- D. Provide trouble call-back service upon notification by Owner:
 1. Provide on-site response within 4 hours of notification.
 2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
 3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.
- E. Maintain an on-site log listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced.

END OF SECTION

SECTION 26 3600
TRANSFER SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Transfer switches for low-voltage (600 V and less) applications and associated accessories:
 - 1. Automatic transfer switches.
 - 2. Includes service entrance rated transfer switches.
 - 3. Remote annunciators.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- C. Section 26 0529 - Hangers and Supports for Electrical Systems.
- D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 2100 - Low-Voltage Electrical Service Entrance.
 - 1. Includes Utility Company contact information.
- F. Section 26 2818 - Enclosed Switches: Safety switches not listed for use as transfer switch equipment.
- G. Section 26 3213 - Engine Generators: For interface with transfer switches.
 - 1. Includes code requirements applicable to work of this section.
 - 2. Includes related demonstration and training requirements.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- C. NEMA ICS 10 Part 1 - Industrial Control and Systems Part 1: Electromechanical AC Transfer Switch Equipment; 2005.
- D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. NFPA 110 - Standard for Emergency and Standby Power Systems; 2013.
- G. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.
- H. UL 1008 - Transfer Switch Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate compatibility of transfer switches to be installed with work provided under other sections or by others.
 - a. Engine Generators: See Section 26 3213.
 - 2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
 - 3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 4. Coordinate the work with placement of supports, anchors, etc. required for mounting.
 - 5. Notify Strategic Energy Solutions, Inc. of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

- B. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features.
 - 1. Where applicable, include characteristic trip curves for overcurrent protective devices upon request.
- C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.
 - 1. Clearly indicate whether proposed short circuit current ratings are based on testing with specific overcurrent protective devices or time durations; indicate short-time ratings where applicable.
- D. Specimen Warranty: Submit sample of manufacturer's warranty.
- E. Evidence of qualifications for installer.
- F. Evidence of qualifications for maintenance contractor (if different entity from installer).
- G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.
- H. Manufacturer's certification that products meet or exceed specified requirements.
- I. Source quality control test reports.
- J. Manufacturer's detailed field testing procedures.
- K. Field quality control test reports.
- L. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
 - 1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.
- M. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- N. Maintenance contracts.
- O. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.
- P. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

- A. Comply with the following:
 - 1. NFPA 70 (National Electrical Code).
 - 2. NFPA 110 (Standard for Emergency and Standby Power Systems); meet requirements for system Level specified in Section 26 3213.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

- D. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with power transfer systems of similar size, type, and complexity; manufacturer's authorized installer.
- E. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.
- F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store transfer switches in accordance with manufacturer's instructions.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's instructions to avoid damage to transfer switch components, enclosure, and finish.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 TRANSFER SWITCHES

- A. Provide complete power transfer system consisting of all required equipment, conduit, boxes, wiring, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Applications:
 - 1. Utilize open transition transfer unless otherwise indicated or required.
 - 2. Neutral Switching (Single Phase, Three Wire and Three Phase, Four Wire Systems):
 - a. Unless otherwise indicated or required, provide solid (unswitched) neutral.
- D. Construction Type: Either "contactor type" (open contact) or "breaker type" (enclosed contact) transfer switches complying with specified requirements are acceptable.
- E. Automatic Transfer Switch:
 - 1. Basis of Design Product(s): Generac Power Systems; www.generac.com/industrial.
- F. Comply with NEMA ICS 10 Part 1, and list and label as complying with UL 1008 for the classification of the intended application (e.g. emergency, optional standby).
- G. Do not use double throw safety switches or other equipment not specifically designed for power transfer applications and listed as transfer switch equipment.
- H. Load Classification: Classified for total system load (any combination of motor, electric discharge lamp, resistive, and tungsten lamp loads with tungsten lamp loads not exceeding 30 percent of the continuous current rating) unless otherwise indicated or required.
- I. Switching Methods:
 - 1. Open Transition:

- a. Provide break-before-make transfer without a neutral position that is not connected to either source, and with interlocks to prevent simultaneous connection of the load to both sources.
2. Obtain control power for transfer operation from line side of source to which the load is to be transferred.
- J. Service Conditions: Provide transfer switches suitable for continuous operation at indicated ratings under the service conditions at the installed location.
- K. Enclosures:
 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 2. Finish: Manufacturer's standard unless otherwise indicated.
- L. Short Circuit Current Rating:
- M. Automatic Transfer Switches:
 1. Description: Transfer switches with automatically initiated transfer between sources; electrically operated and mechanically held.
 2. Control Functions:
 - a. Automatic mode.
 - b. Test Mode: Simulates failure of primary/normal source.
 - c. Voltage and Frequency Sensing:
 - 1) Undervoltage sensing for each phase of primary/normal source; adjustable dropout/pickup settings.
 - 2) Undervoltage sensing for alternate/emergency source; adjustable dropout/pickup settings.
 - 3) Underfrequency sensing for alternate/emergency source; adjustable dropout/pickup settings.
 - d. Outputs:
 - 1) Contacts for engine start/shutdown (except where direct generator communication interface is provided).
 - 2) Auxiliary contacts; one set(s) for each switch position.
 - e. Adjustable Time Delays:
 - 1) Engine generator start time delay; delays engine start signal to override momentary primary/normal source failures.
 - 2) Transfer to alternate/emergency source time delay.
 - 3) Retransfer to primary/normal source time delay.
 - 4) Engine generator cooldown time delay; delays engine shutdown following retransfer to primary/normal source to permit generator to run unloaded for cooldown period.
 - f. In-Phase Monitor (Open Transition Transfer Switches): Monitors phase angle difference between sources for initiating in-phase transfer.
 - g. Engine Exerciser: Provides programmable scheduled exercising of engine generator selectable with or without transfer to load; provides memory retention during power outage.
 3. Status Indications:
 - a. Connected to alternate/emergency source.
 - b. Connected to primary/normal source.
 - c. Alternate/emergency source available.
 4. Other Features:
 - a. Event log.
 5. Automatic Sequence of Operations:
 - a. Upon failure of primary/normal source for a programmable time period (engine generator start time delay), initiate starting of engine generator where applicable.

- b. When alternate/emergency source is available, transfer load to alternate/emergency source after programmable time delay.
 - c. When primary/normal source has been restored, retransfer to primary/normal source after a programmable time delay. Bypass time delay if alternate/emergency source fails and primary/normal source is available.
 - d. Where applicable, initiate shutdown of engine generator after programmable engine cooldown time delay.
- N. Service Entrance Rated Transfer Switches:
- 1. Furnished with integral disconnecting and overcurrent protective device on the primary/normal source and with ground-fault protection where indicated.
 - 2. Listed and labeled as suitable for use as service equipment according to UL 869A.
- O. Remote Annunciators:
- 1. Remote Annunciator Mounting: Wall-mounted; Provide flush-mounted annunciator for finished areas and surface-mounted annunciator for non-finished areas unless otherwise indicated.
 - 2. Transfer Switch Status Indications:
 - a. Connected to alternate/emergency source.
 - b. Connected to primary/normal source.
 - c. Alternate/emergency source available.

2.02 SOURCE QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Perform production tests on transfer switches at factory to verify operation and performance characteristics prior to shipment. Include certified test report with submittals.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that the ratings and configurations of transfer switches are consistent with the indicated requirements.
- C. Verify that rough-ins for field connections are in the proper locations.
- D. Verify that mounting surfaces are ready to receive transfer switches.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1.
- B. Install transfer switches in accordance with manufacturer's instructions.
- C. Arrange equipment to provide minimum clearances and required maintenance access.
- D. Provide required support and attachment in accordance with Section 26 0529.
- E. Install transfer switches plumb and level.
- F. Unless otherwise indicated, mount floor-mounted transfer switches on properly sized 3 inch high concrete pad constructed in accordance with Section 03 3000.
- G. Provide grounding and bonding in accordance with Section 26 0526.
- H. Identify transfer switches and associated system wiring in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.

- C. Prepare and start system in accordance with manufacturer's instructions.
- D. Automatic Transfer Switches:
 - 1. Inspect and test in accordance with NETA ATS, except Section 4.
 - 2. Perform inspections and tests listed in NETA ATS, Section 7.22.3. The control wiring insulation-resistance tests listed as optional are not required.
- E. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.04 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of transfer switches to Owner, and correct deficiencies or make adjustments as directed.
- D. Training: Train Owner's personnel on operation, adjustment, and maintenance of transfer switches.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Provide minimum of four hours of training.
- E. Coordinate with related generator demonstration and training as specified in Section 26 3213.

3.06 PROTECTION

- A. Protect installed transfer switches from subsequent construction operations.

3.07 MAINTENANCE

- A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

END OF SECTION

**SECTION 26 5100
INTERIOR LIGHTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior luminaires.
- B. Exit signs.
- C. Ballasts and drivers.
- D. Lamps.
- E. Luminaire accessories.

1.02 REFERENCE STANDARDS

- A. ANSI C78.379 - American National Standard for Electric Lamps -- Reflector Lamps -- Classification of Beam Patterns; 2006.
- B. ANSI C82.1 - American National Standard for Lamp Ballast - Line Frequency Fluorescent Lamp Ballast; 2004.
- C. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type); 2002.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- E. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.
- F. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. NFPA 101 - Life Safety Code; 2015.
- I. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
- J. UL 1598 - Luminaires; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Ballast product specification sheet from manufacturer.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70 and NFPA 101.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.05 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide ten year pro-rata warranty for batteries for self-powered exit signs.

1.07 EXTRA MATERIALS

- A. See Section 01 6000 - Product Requirements, for additional provisions.

PART 2 PRODUCTS

3.01 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.

3.02 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70 and NFPA 101.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

3.03 EXIT SIGNS

- A. Description: Internally illuminated exit signs with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
 - 1. Number of Faces: Single or double as indicated or as required for the installed location.
 - 2. Directional Arrows: As indicated or as required for the installed location.

3.04 LAMPS

- A. Manufacturers:
 - 1. General Electric Company/GE Lighting: www.gelighting.com.
 - 2. Osram Sylvania: www.sylvania.com.
 - 3. Philips Lighting Company: www.lighting.philips.com.
- B. Lamps - General Requirements:
 - 1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
 - 2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
 - 3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
 - 4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Strategic Energy Solutions, Inc. to be inconsistent in perceived color temperature.

3.05 ACCESSORIES

PART 3 EXECUTION

4.01 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of luminaires provided under this section.
- B. Install products according to manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship), NECA 500 (commercial lighting), and NECA 502 (industrial lighting).
- D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- E. Suspended Ceiling Mounted Luminaires:
 - 1. Do not use ceiling tiles to bear weight of luminaires.
 - 2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
 - 3. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
 - 4. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.
- F. Recessed Luminaires:
 - 1. Install trims tight to mounting surface with no visible light leakage.
- G. Suspended Luminaires:
 - 1. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
 - 2. Unless otherwise indicated, support pendants from swivel hangers.
- H. Install accessories furnished with each luminaire.
- I. Bond products and metal accessories to branch circuit equipment grounding conductor.
- J. Exit Signs:
 - 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
- K. Install lamps in each luminaire.

4.02 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect each product for damage and defects.
- C. Operate each luminaire after installation and connection to verify proper operation.
- D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Strategic Energy Solutions, Inc..

4.03 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Strategic Energy Solutions, Inc.. Secure locking fittings in place.
- B. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Strategic Energy Solutions, Inc. or authority having jurisdiction.

4.04 CLEANING

- A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

4.05 CLOSEOUT ACTIVITIES

- A. Just prior to Substantial Completion, replace all lamps that have failed .

4.06 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

**SECTION 26 5600
EXTERIOR LIGHTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior luminaires.
- B. Poles and accessories.
- C. Luminaire accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.
- B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- C. Section 26 0537 - Boxes.
- D. Section 26 2726 - Wiring Devices: Receptacles for installation in poles.
- E. Section 26 2813 - Fuses.

1.03 REFERENCE STANDARDS

- A. ANSI O5.1 - American National Standard for Wood Poles -- Specifications and Dimensions; 2015.
- B. IEEE C2 - National Electrical Safety Code; 2012.
- C. IESNA LM-5 - Photometric Measurements of Area and Sports Lighting Installations; Illuminating Engineering Society; 2004 (Reaffirmed 2007).
- D. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).
- E. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; Illuminating Engineering Society; 2008.
- F. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society; 2015.
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- H. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2006.
- I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 1598 - Luminaires; Current Edition, Including All Revisions.
- K. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
 - 2. Notify Strategic Energy Solutions, Inc. of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:

1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
2. Provide photometric calculations where luminaires are proposed for substitution upon request.
3. Provide structural calculations for each pole proposed for substitution.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
 1. LED Luminaires:
 - a. Include estimated useful life, calculated based on IES LM-80 test data.
 - b. Include IES LM-79 test report upon request.
 2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IESNA LM-63 standard format upon request.
 3. Lamps: Include rated life and initial and mean lumen output.
 4. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.
- D. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed and comply with designated structural design criteria.
- E. Field Quality Control Reports.
 1. Include test report indicating measured illumination levels.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- G. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. See Section 01 6000 - Product Requirements, for additional provisions.
 2. Extra Fuses: Five percent of total quantity installed for each type, but not less than two of each type.
 3. Touch-Up Paint: 2 gallons, to match color of pole finish.
- I. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

- C. Receive, handle, and store wood poles in accordance with ANSI O5.1.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide three year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- G. LED Luminaires:
 - 1. Components: UL 8750 recognized or listed as applicable.
 - 2. Tested in accordance with IES LM-79 and IES LM-80.
 - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
- H. Exposed Hardware: Stainless steel.

2.03 POLES

- A. All Poles:
 - 1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
 - 2. Structural Design Criteria:
 - a. Wind Load: Include effective projected area (EPA) of luminaire(s) and associated supports and accessories to be installed.
 - b. Dead Load: Include weight of proposed luminaire(s) and associated supports and accessories.

2.04 ACCESSORIES

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of luminaires provided under this section.
- B. Install products according to manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship) and NECA/IESNA 501 (exterior lighting).
- D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- E. Pole-Mounted Luminaires:
 - 1. Maintain the following minimum clearances:
 - a. Comply with IEEE C2.
 - b. Comply with utility company requirements.
 - 2. Foundation-Mounted Poles:
 - a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Section 03 3000.
 - 1) Install anchor bolts plumb per template furnished by pole manufacturer.
 - 2) Position conduits to enter pole shaft.
 - b. Install foundations plumb.
 - c. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
 - d. Tighten anchor bolt nuts to manufacturer's recommended torque.
 - 3. Grounding:
 - a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
 - 4. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.
- F. Install accessories furnished with each luminaire.
- G. Bond products and metal accessories to branch circuit equipment grounding conductor.
- H. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect each product for damage and defects.
- C. Operate each luminaire after installation and connection to verify proper operation.
- D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Strategic Energy Solutions, Inc..
- E. Measure illumination levels at night with calibrated meters to verify conformance with performance requirements. Record test results in written report to be included with submittals.
 - 1. Test according to IESNA LM-5 (area and sports lighting installations).

3.05 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Strategic Energy Solutions, Inc.. Secure locking fittings in place.

3.06 CLEANING

- A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of luminaires to Strategic Energy Solutions, Inc., and correct deficiencies or make adjustments as directed.
- D. Just prior to Substantial Completion, replace all lamps that have failed.

3.08 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

**SECTION 26 5701
OCCUPANCY SENSORS AND INDOOR PHOTOCELLS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall Switch Sensors - Small Areas
- B. Wall Switch Sensors - Large Areas
- C. Low Voltage Occupancy Sensors
- D. Dual Technology Occupancy Sensors
- E. Power Packs
- F. Line Voltage Occupancy Sensors

1.02 RELATED SECTIONS

- A. Section 26 5100 Interior Luminaires

1.03 REFERENCES

- A. ANSI/ASHREA/IESNA Standard 90.1-1999
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2002.
- C. IEEE Std 2000.1-1998
- D. UL 916 Energy Management Equipment

1.04 SYSTEM DESCRIPTION

- A. The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system and/or daylight harvesting system so that lighting is controlled automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area or natural lighting conditions change.
- B. The occupancy sensor based lighting control and/or daylight harvesting system shall accommodate all conditions of space utilization and all irregular work hours and habits.

1.05 WORK INCLUDED

- A. Contractor's work to include all labor, materials, tools, appliances, control hardware, sensor, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as described herein.
- B. Contractor/Supplier shall examine all general specification provisions and drawings for related electrical work required as work under Division 16.
- C. Contractor shall coordinate all work described in this section with all other applicable plans and specifications, including but not limited to wiring, conduit, fixtures, HVAC systems and building management systems.

1.06 SUBMITTALS

- A. Product Data: Provide dimensions, ratings, and performance data.
- B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- C. Submit a lighting plan clearly marked by manufacturer showing proper product, location and orientation of each sensor.
- D. Submit any interconnection diagrams per major subsystem showing proper wiring.
- E. Catalog sheets must clearly state any load restrictions when used with electronic ballasts.
- F. Operation and Maintenance Data: Instructions for each product.

- G. Certificates: Certify that products of this section meet or exceed specified requirements.
- H. Warranty: Submit manufacturer warranty and ensure that forms have been completed in owner's name and registered with manufacturer.

1.07 QUALITY ASSURANCE

- A. Products supplied shall be from a single manufacturer that has been continuously involved in manufacturing of occupancy sensors for a minimum of five (5) years. Mixing of manufacturers shall not be allowed.
- B. All components shall be U.L. listed, offer a five (5) year warranty and meet all state and local applicable code requirements.
- C. Products shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.
- D. Wall switch products must be capable of withstanding the effects of inrush current. Submittals shall clearly indicate the method used.

1.08 WARRANTY

- A. Contractor shall warrant all equipment furnished in accordance to this specification to be undamaged, free of defects in materials and workmanship, and in conformance with the specifications for a period of not less than 5 years.
- B. The suppliers obligation shall include repair or replacement, and testing without charge to the owner, all or any parts of equipment which are found to be damaged, defective or non-conforming and returned to the supplier.
- C. The warranty shall commence upon the owner's acceptance of the project.
- D. Warranty on labor shall be for a minimum period of one (1) year.

1.09 COMMISSIONING

- A. It shall be the contractor's responsibility to make all proper adjustments to assure owner's satisfaction with the occupancy system, or;
- B. Factory Startup (Optional): It shall be the manufacturer's responsibility to verify all proper adjustments and train owner's personnel to ensure owner's satisfaction with the occupancy system. This service is provided at an additional cost.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Sensor Switch, Inc.
- B. The Wattstopper
- C. Leviton
- D. Hubbel
- E. Lutron
- F. Novitas, Inc.

2.02 SUBSTITUTIONS

- A. Approved manufacturer shall be Sensor Switch, Inc.
- B. Substitutions must be submitted no less than 5 days prior to bid date. An AutoCAD drawing of the facility showing coverage patterns and technical data must be provided with substitution request. All substitutions must clearly identify any and all exceptions to the specifications with a detailed explanation as to the exception. If substitution is approved, the contractor shall bear the responsibility of a fully functional system to the owner's and specifying engineer/architect's satisfaction.

2.03 GENERAL REQUIREMENTS

- A. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.
- B. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
- C. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.
- D. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.
- E. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.
- F. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.
- G. All sensors shall have UL rated, 94V-0 plastic enclosures.
- H. Outdoor motion sensors shall have UL 773A ratings.
- I. Outdoor sensors shall have an operating temperature range of -40°F to+130°F.
- J. To ensure complete protection from weather elements and exposure, outdoor sensors shall be manufactured with precision double-shot tooling and contain internal silicon gaskets.

2.04 WALL SWITCH OCCUPANCY SENSORS - SMALL AREAS

- A. Sensor shall provide wall-to-wall PIR detection such that small hand motions are detected within an area up to 300 square feet minimum.
- B. In areas with periodic or permanent obstruction to a sensor's field of view, sensors that utilize dual technology detection shall be used .
- C. For applications requiring independent control of two loads, a sensor with two dual relays and dual override switches shall be required. Each relay shall have independent programmable occupancy time delays.
- D. Sensors shall be capable of switching both 120 VAC and 277 VAC and run off of 50/60 Hz power. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, and ¼ HP motor load.
- E. Sensor shall recess into single gang switch box and fit a standard GFI opening.
- F. Sensor shall not allow any leakage of current to pass to the load when sensor is in the unoccupied (off) condition. Sensor shall not require a minimum load to be connected in order to function.
- G. Sensor shall have optional features for photocell/daylight override, vandal resistant lens, low temperature/high humidity operation.
- H. Wall Switch sensors shall have field programmable adjustments for selecting operational modes, occupancy time delays, minimum on time, and photocell set-point as applicable.
- I. All models shall be capable of both Auto-On and Manual On operation.
- J. All models shall have a "Predictive Off" mode where user can manually turn the lights off when leaving the room and still have them come on automatically when they return to space.

2.05 WALL SWITCH OCCUPANCY SENSORS - LARGE AREAS

- A. Sensor shall provide wall-to-wall PIR detection such that small hand motions are detected within an area up to 900 square feet minimum.

- B. In areas with periodic or permanent obstruction to a sensor's field of view, sensors that utilize dual technology detection shall be used.
- C. For applications requiring independent control of two loads, a sensor with two dual relays and dual override switches shall be required. Each relay shall have independent programmable occupancy time delays.
- D. Sensors shall be capable of switching both 120 VAC and 277 VAC and run off of 50/60 Hz. Load ratings shall be 13A each pole, ¼ HP motor load.
- E. Sensor shall not allow any leakage of current to pass to the load when sensor is in the unoccupied (Off) condition. Sensor shall not require a minimum load to be connected in order to function.

2.06 LOW VOLTAGE OCCUPANCY SENSORS

- A. The installing contractor shall install one or more sensors with coverage areas that cover the entire space and all entrance points. Exact placement and quantity required shall be per manufacturer's best practice recommendations.
- B. In areas with periodic or permanent obstruction to a sensor's field of view, sensors that utilize dual technology detection shall be used.
- C. Sensors shall utilize a digital signal analysis component, so as to provide a high degree of RF immunity.
- D. Sensors shall operate on 12 to 24 VAC or VDC.
- E. Sensors shall have test mode that temporarily shortens/disable all time delays (e.g., minimum on, occupancy, photocell transition, dimming rates) such that an installer can quickly test operation of sensor. Test mode shall time out and return sensor to normal operation should the installer forget to disable test mode after installation.
- F. Sensors shall have optional features for on/off photocell control, automatic dimming control photocell, high/low occupancy based dimming, and usage in low temperature/high humidity environments.

2.07 ULTRASONIC OCCUPANCY SENSORS

- A. Ultrasonic sensors shall utilize advanced signal processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.
- B. Ultrasonic operating frequency shall be crystal controlled at 25 kHz within $\pm 0.005\%$ tolerance, 32 kHz within $\pm 0.002\%$ tolerance, or 40 kHz $\pm 0.002\%$ tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.

2.08 DUAL TECHNOLOGY OCCUPANCY SENSORS

- A. Dual technology sensors shall consist of passive infrared and ultrasonic or microphonic technologies for occupancy detection.
- B. Where specified, dual technology sensors shall offer daylighting footcandle adjustment control and be able to accommodate dual level lighting.
- C. Dual technology sensors shall be mounted to avoid detection outside the controlled area when doors are left open.

2.09 POWER PACKS

- A. Power packs shall accept and switch 120 or 277 VAC, be plenum rated, and provide class 2 power for up to 14 remote sensors.
- B. When required by local code, power pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.

- C. Power pack shall incorporate a Class 1 relay and an AC electronic switching device. The AC electronic switching device shall make and break the load, while the relay shall carry the current in the on condition. This system shall provide full 20 Amp switching of all load types, and be rated for 400,000 cycles.
- D. Power packs shall be single circuit, or two circuits. Slave packs may be used to control additional circuits. When two circuit power packs, or slave packs are used, the power packs must be wired directly to circuit breaker. Otherwise, power packs may be wired on the line or load side of the local switch.

2.10 LINE VOLTAGE OCCUPANCY SENSORS

- A. Sensors shall be self-contained and accept Class 1 wiring directly without the use of a power pack.
- B. The installing contractor shall install one or more sensors with coverage areas that cover the entire space and all entrance points. Exact placement and quantity required shall be per manufacturer's best practice recommendations.
- C. In areas with periodic or permanent obstruction to a sensor's field of view, sensors that utilize dual technology detection shall be used.
- D. Sensors shall utilize a digital signal analysis component, so as to provide a high degree of RF immunity.
- E. Multiple sensors controlling the same load shall be wired in parallel.
- F. For applications requiring independent control of two loads, a sensor with two dual relays shall be required. Each relay shall have independent programmable occupancy time delays.
- G. Dual relay sensors shall have an optional operational mode called "Alternating On" where when during unoccupied periods, one relay is always left closed (thus one load is always on). The particular relay that is left closed alternates each cycle so that the aging of the connected lamps is even.
- H. Sensors shall be capable of switching both 120 VAC and 277 VAC and run off of 50/60 Hz power. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, and ¼ HP motor load.
- I. Wall mounted sensors must be installed at 7 to 8 feet above the floor. Single and two circuit units shall be available.
- J. High bay sensors controlling HID Bi-Level must incorporate a "Start to High" timer on initial power up to provide full light output for up to 20 minutes to prevent shortened lamp life.
- K. Sensors shall have test mode that temporarily shortens/disable all time delays (e.g., minimum on, occupancy, photocell transition, dimming rates) such that an installer can quickly test operation of sensor. Test mode shall time out and return sensor to normal operation should the installer forget to disable test mode after installation.
- L. Sensors shall have optional features for on/off photocell control, automatic dimming control photocell, high/low occupancy based dimming, and usage in low temperature/high humidity environments.

PART 3 EXECUTION

3.01 INSTALLATION

- A. It shall be the contractor's responsibility to locate and aim sensory in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.

- B. It is the contractor's responsibility to arrange a pre-installation meeting with the manufacturer's factory authorized representative, at the owner's facility, to verify placement of sensors and installation criteria.
- C. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The contractor shall also provide, at the owner's facility, the training necessary to familiarize the owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

3.02 INTERFACE WITH OTHER WORK

- A. Verify that installed sensors are coordinated with all lighting controls and luminaires to provide a complete lighting control system.

3.03 FIELD QUALITY CONTROL

- A. Upon completion of the installation, the system shall be completely tested by the contractor who will verify all adjustments and sensor placement to ensure a trouble-free occupancy-based lighting control system.

3.04 SCHEDULES

- A. Refer to Drawings.

END OF SECTION

**SECTION 27 0501
TELECOMMUNICATIONS GENERAL REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

A. RELATED DOCUMENTS

1. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this section.
2. Provide all items, articles, materials, operations or methods listed, mentioned or scheduled on drawings and/or herein, including all labor, materials, equipment and incidentals necessary and required for their completion.
3. The items in this section are supplementary to the requirements set forth in other portions of the specifications as indicated under Item "A" above.
4. Division 1, Section 01300 "Submittals" requirements apply to this section and will require the Contractors participation in the Above Ceiling Coordination Program,

B. DRAWINGS

1. The drawings show the location and general arrangement of equipment, electrical systems and related items. They shall be followed as closely as elements of the construction will permit.
2. Examine the drawings of other trades and verify the conditions governing the work on the job site. Arrange work accordingly, providing such fittings, conduit, junction boxes and accessories as may be required to meet such conditions.
3. Deviations from the drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect.

C. CODES, PERMITS AND FEES

1. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for telecommunications work shall be secured and paid for by the contractor. All work shall conform to all applicable codes, rules and regulations.
2. Rules of local service providers shall be complied with. Check with the local exchange carrier supplying service to the installation and determine all raceways and devices required including, but not limited to, all terminal cabinets, backboards, space requirements, etc.
3. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed drawings or diagrams which may be required by the governing authorities. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern.

D. STANDARDS OF MATERIAL AND WORKMANSHIP:

1. All materials shall be new. The electrical and physical properties of all materials, and the design, performance characteristics, and methods of construction of all items of equipment, shall be in accordance with the latest issue of the various, applicable Standard Specifications of the following recognized authorities:
 - a. A.N.S.I.- American National Standards Institute
 - b. A.S.T.M. - American Society for Testing Materials
 - c. I.C.E.A. - Insulated Cable Engineer's Association
 - d. I.E.E.E. - Institute of Electrical and Electronics Engineers
 - e. BICSI - Building Industry Consulting Services International
 - f. N.E.C. - National Electrical Code
 - g. N.E.M.A. - National Electrical Manufacturer's Association
 - h. TIA/EIA - Telecommunications Industry Association/Electronics Industry Association
 - i. U.L. - Underwriters Laboratories, Inc.

2. Perform all work in a first class and workmanlike manner, in accordance with the latest accepted standards and practices for the Trades involved.
3. All equipment of the same or similar systems shall be by the same manufacturer .

E. RECORD DRAWINGS

1. Provide complete operating and maintenance instruction manuals covering all telecommunications equipment herein specified, together with parts lists. All literature shall be furnished in triplicate for Owner and shall be bound in book or ring binder form as directed by Architect/Engineer.
2. The operating and maintenance instructions shall include a brief, general description for all electrical systems including, but not limited to:
 - a. 1. Routine maintenance procedures.
 - b. 3. Contractor's telephone numbers for warranty repair service.
 - c. 4. Shop drawings.
 - d. 5. Recommended spare parts lists.
 - e. 6. Names and telephone numbers of major material suppliers.
3. Provide revised telecommunications working drawings indicating "as-built" conditions. Drawings shall indicate all changes that have occurred during construction. Properly and identify backbone and horizontal wiring pathways. Locate all network and workstation devices. Identify all devices on plan with proper labeling. "As-Built" drawings shall be submitted in Revit or compatible electronic format.

F. MATERIAL AND EQUIPMENT MANUFACTURERS

1. All items of equipment shall be furnished complete with all accessories normally supplied with the catalog items listed and all other accessories necessary for a complete and satisfactory operating system. All equipment and materials shall be new and shall be standard products of manufacturers regularly engaged in the production of telecommunications equipment and shall be of the manufacturer's latest design.

G. USE OF EQUIPMENT

1. The use of any equipment, or any part thereof for purposes other than testing even with the Owner's consent, shall not be construed to be an acceptance of the work on the part of the Owner, nor be construed to obligate the Owner in any way to accept improper work or defective materials.

H. WORK SPECIFIED UNDER OTHER DIVISIONS:

1. The following items are an integral part of the telecommunications system and may be provided by the Electrical Contractor or the Telecommunications sub-contractor. It is the responsibility of the Telecommunications sub-contractor to coordinate with the Electrical Contractor when submitting Bid. The Telecommunications sub-contractor shall ultimately be responsible for the proper application and installation of all items-affecting the telecommunications system.
 - a. Raceways and methods for interior pathways:
 - 1) 26 0534 Conduit
 - 2) 26 0535 Surface Raceways
 - 3) 26 0537 Boxes
 - 4) 26 2716 Cabinets and Enclosures
 - b. Grounding for Telecommunications System:
 - 1) 26 0526 Grounding and Bonding
 - c. Raceways and methods for exterior pathways:
 - 1) 02 5820 Underground Electrical Ducts

1.02 SUBMITTALS

- A. All shop drawings shall be submitted in groupings of similar and/or related items (cable and connectors, network electronics, etc.). Incomplete submittal groupings will be returned unchecked.

- B. Submit for approval eight (8) copies of shop drawings for all telecommunications systems or equipment but not limited to the items listed below. Where items are referred to by symbolic designation on the drawings and specifications, all submittals shall bear the same designation. Refer to other sections of the specifications for additional requirements.
 - 1. Copper splice kits, copper equipment, materials and accessories
 - 2. Connectors, couplers and adapters
 - 3. Patch panels, patch cords, and connecting blocks
 - 4. Equipment racks, cable management devices, and all accessories
 - 5. Cable support devices

1.03 WARRANTY

- A. See Section 01780 - Closeout Submittals, for additional warranty requirements.
- B. Contractor guarantees that the installation is free from defects and agrees to replace or repair, any part of this installation which becomes defective within a period of one year following final acceptance, provided that such failure is due to defects in the equipment, material or installation or to follow the specifications and drawings. File with the Owner any and all guarantees from the equipment manufacturers.

PART 2 PRODUCTS

2.01 PATHWAYS

- A. General Requirements: Comply with TIA/EIA-569-A.
- B. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.
 - 1. Comply with NFPA 70 and UL 2043 for fire-resistant and lowsmoke-production characteristics.
 - 2. Support brackets with cable tie slots for fastening cable ties to brackets.
 - 3. Lacing bars, spools, J-hooks, and D-rings
 - 4. Straps and other devices.
- C. Conduit and Boxes: Comply with requirements in Division 26 section " Raceway and Boxes for Electrical Systems". Flexible metal conduit shall not be used.

2.02 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels specified in Division 06 Section " Rough Carpentry."

2.03 GROUNDING

- A. Comply with requirements in Division 26 Section " Grounding and Bonding for Electrical Systems." for grounding conductors and connectors.
- B. Telecommunications Bus Bars:
 - 1. Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
 - 2. Ground Bus Bar: Copper, sized per Drawings, with 9/32 inch holes spaced 1-1/8 inches apart.
 - 3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.
- C. Comply with ANSI-J-STD-607-A

PART 3 EXECUTION

3.01 WORK PERFORMED BY OTHERS

- A. Electrical contractor shall install 4 inch sq. sheet steel wall boxes, minimum 1 " trade size conduit (or as indicated on drawings) stubbed 12" above ceiling with 6" radius, 90 deg bend at top in the direction towards route to destination, and plastic bushing.

- B. The Owner will provide network electronics equipment in Communications Rooms all as required.

3.02 DEMOLITION WORK

- A. In general, demolition work is indicated on the drawings. However, the contractor shall visit the job site to determine the full extent and character of this work.
- B. Unless specifically noted to the contrary, removed materials shall not be reused in the work. Salvaged materials that are to be reused shall be stored safe against damage and turned over to the appropriate trade for reuse. Salvaged materials of value that are not to be reused shall remain the property of the Owner unless such ownership is waived. Items on which the Owner waives ownership shall become the property of the contractor, who shall remove and legally dispose of same, away from the premises.
- C. Where equipment or fixtures are removed, outlets shall be properly blanked off, and conduits capped. After alterations are done, the entire installation shall present a "finished" look, as approved by the Architect/Engineer. The original function of the present systems to be modified shall not be changed unless required by the specific revisions to the system as specified or as indicated.
- D. Reroute signal wires, lighting and power wiring as required to maintain service. Where walls and ceilings are to be removed-as shown on the drawings, the conduit is to be cut off by the Electrical Trades so that the abandoned conduit in these walls and ceilings may be removed with the walls and ceilings by the Architectural Trades. All dead-end conduit runs shall be plugged at the remaining line outlet boxes or at the panels.
- E. Where new walls and/or floors are installed which interfere with existing outlets, devices, etc. , the Electrical Trades shall adjust, extend and reconnect such items as required to maintain continuity of same.
- F. All electrical work in altered and unaltered areas shall be run concealed wherever possible. Use of "Wiremold" or exposed conduits will be permitted only where approved by the Engineer and as specifically indicated on the Drawings.

3.03 WORK IN EXISTING BUILDINGS

- A. The Owner will provide access to existing buildings as required. However, the contractor, once work is started in the existing building, shall complete same without interruption so as to return work areas as soon as possible to Owner.
- B. Adequately protect and preserve all existing and newly installed work. Promptly repair any damage to same at contractor's expense.
- C. Consult with the Owner's representative as to the methods of carrying on the work so as not to interfere with the Owner's operation any more than absolutely necessary. Accordingly, all telecommunications services shall be kept in operation as long as possible and the services shall only be interrupted at such time as will be designated by the Owner's representative.

3.04 COORDINATION

- A. Install work to avoid interference with work of other trades including, but not limited to, architectural, mechanical and electrical trades. Remove and relocate any work that causes an interference at contractor's expense. Disputes regarding the cause of an interference will be resolved by the Owner's representative or Architect/Engineer.

3.05 CHASES AND RECESSES

- A. Provided by the architectural trades, but the contractor shall be responsible for their accurate location and size.

3.06 SLEEVES

- A. Provide and install rigid steel conduit sleeves cut to length wherever conduits or cabling pass through floors or cable passes through openings in walls.

- B. All sleeves through the floor are to extend 2 inch above floor. Provide escutcheons at each sleeve in finished areas.

3.07 CUTTING, PATCHING AND DAMAGE TO OTHER WORK

- A. Refer to General Conditions for requirements.

3.08 CLEANING

- A. All debris shall be removed daily as required to maintain the work area in a neat, orderly condition.
- B. Final cleanup shall include, but not be limited to, cleaning all telecommunications equipment spaces, devices, cover plates, and removing all scrap cable and debris from pathways.

3.09 EXTRA WORK

- A. For any extra electrical work which may be proposed, this Contractor shall furnish to the General Contractor, an itemized breakdown of the estimated cost of the materials and labor required to complete this work. The Contractor shall proceed only after receiving a written order from the General Contractor establishing the agreed price and describing the work to be done

3.10 DRAWINGS AND MEASUREMENTS

- A. These Specifications and accompanying Drawings are intended to describe and provide for finished work. They are intended to be cooperative, and what is called for by either shall be as binding as if call for by both. The Contractor will understand that the work herein described shall be complete in every detail.
- B. The Drawings are not intended to be scaled for rough-in measurements or to serve as Shop Drawings. Field measurements, necessary for ordering materials and fitting the installation to the building construction and arrangement, shall be taken by the Contractor.

3.11 INSTALLATION

- A. Install all equipment in strict accordance with all directions and recommendations furnished by the manufacturer. Where such directions are in conflict with the drawings and specifications, report such conflicts to the Architect/Engineer for resolution.

3.12 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 4000.

END OF SECTION

SECTION 27 0801
CABLE PLANT ADMINISTRATION AND TESTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Labeling.
- B. UTP System Testing.
- C. Video System Testing.

1.02 REFERENCES

- A. ANSI/NFPA 70 National Electrical Code.
- B. NFPA-297 Guide on Principles and Practices for Communication Systems.
- C. ANSI/TIA/EIA 568-A Commercial Building Telecommunications Cabling Standard
- D. ANSI/TIA/EIA 569-A Commercial Building Standard for Telecommunications Pathway and Spaces.
- E. ANSI/TIA/EIA 607 Commercial Building Grounding and Bonding Requirements for Telecommunications.
- F. ANSI/IEEE-110-1992 Powering and Grounding Sensitive Electronic Equipment.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

PART 3 EXECUTION

2.01 LABELING

- A. Contractor to install all faceplate and equipment labels in accordance with manufacturer's recommendations and the specifications. All labels shall be neatly installed and shall be level with the floor and properly aligned on the faceplate.
- B. All pieces of voice and data equipment, including wires, cables, fibers and their respective terminations shall be labeled and identified in accordance with ANSI/TIA/EIA Standard 606.
- C. Labels shall meet the requirements of UL 969 as outlined in the ANSI/TIA/EIA Standard 606.
- D. All horizontal and backbone subsystem copper and fiber cables shall be labeled at each end. Labeling is required at intermediate points such as pullboxes and consolidation points (where appropriate).
- E. Do not install labels closer than 3" to the termination point.
- F. Patch panel labels shall be printed with the associated user data jack number. Contractor shall submit a sample of patch panel label strips to the Engineer for approval prior to installation.
- G. Recommended labeling scheme at both ends is "room no.-outlet no.-jack no." (e.g. Z116-11 represents the top jack in the first outlet in Rm Z116 starting from the north wall and proceeding clockwise). All voice jacks shall be identified by the letter "V" and all data jacks by the letter "D" (e.g. Z116-1-V1 , Z116-1-D1, Z116-1-D2, etc.) Labeling shall be consistent at each end of cabling and at workstation outlet and patch panel or connecting block.

2.02 DOCUMENTATION

- A. Provide As-Built drawings indicating labeling at all outlet locations.

2.03 UTP SYSTEM TESTING

- A. Upon completion of the cable installation, the Contractor shall perform complete copper cable certification tests, according to all manufacturer's requirements for warranty and all testing required by TIA/EIA, including, but not limited to:
 - 1. Continuity checks on each cable, checking for opens and shorts.
 - 2. Cable length (Channel and Permanent Link).

3. Correct pair polarity.
4. Correct cable labeling at both ends.
- B. Tests shall be performed with connectors installed.
- C. Any outlet, cable or component not satisfactorily passing tests or failing to meet quality installation standards as described in the specification, shall be repaired and/or replaced at the Contractor's expense.
- D. The Contractor shall prepare complete cable test reports for all installed cables for review and acceptance by the Engineer prior to acceptance of the cabling system.
- E. Category 6 UTP cable and patch cord installations shall be fully tested and verified in accordance with EIA/TIA-568-C.1.
- F. The cable tester shall be calibrated to the type of cable being tested prior to beginning the cable certifications.
- G. The Category 6 Horizontal Cable Certification report shall have complete testing of Permanent Link for voice drops and Channel for data drops, at frequency increments up to 250MHz as indicated in TIA/EIA-568-C.1, and shall include the following:
 1. Cable/Faceplate Number -- matching faceplate numbers on patch panels
 2. Test Date
 3. Cable Length
 4. Wire-Map
 5. Network Tests for 100BASE-TX and 1000BASE-T
 6. Attenuation
 7. Near End CrossTalk (NEXT)
 8. Power-sum NEXT (PS-NEXT)
 9. Attenuation to Cross Talk Ratio (ACR)
 10. Power-sum Attenuation to Cross Talk Ratio
 11. Equal Level Far End CrossTalk (ELFEXT)
 12. Power-sum Equal Level Far End CrossTalk (PS-ELFEXT)
 13. Return Loss
 14. Propagation Delay
 15. Delay Skew
 16. Signal to Noise Ratio
- H. After the horizontal cable tests have been performed, the Contractor shall install the faceplate labels and modular jack dust covers.

2.04 VIDEO SYSTEM TESTING

- A. Performance Testing
 1. Unless restricted by the published equipment specifications, the following performance standards shall be met by each system.
 2. Video:
 - a. S/N (Peak to RMS) unweighted DC to 4.2 MHz: 55dB minimum.
 - b. Crosstalk, unweighted DC to 4.2MHz: 45dB minimum.
 - c. Frequency Response: Within +/- 0.5 dB to 4.2 MHz.
 - d. Line and Field Tilt: 2% maximum.
 - e. Differential Gain: 3% maximum.
 - f. Differential Phase: 2 degrees maximum.
 3. RF & Broadband Distribution:
 - a. System Frequency Response: 5-550 MHz.
 - b. System Tilt: 6dBmv Maximum.
 - c. Maximum System Level: +40dBmv at visual carrier. aural carrier shall be -6dBmv with respect to visual carrier.
 - d. System level at Outlet: +10dBmv +/- 3dBmv.

- e. Signal Leakage: Maximum signal leakage from system shall not exceed -40dBm at CATV. Channel "A" (121.25 MHz) and shall not exceed -40dBm at CATV. Channel "W" (295.25 MHz).
 - f. Spurious Output: Spurious output of modulators/processors shall not exceed 70dBm.
 - g. System Carrier to Noise: Shall exceed -54dBm at last tap.
 - h. System Operating Range: system shall perform as specified at temperatures between 32 & 120 degrees F.
 - i. Hum and Noise: system hum and noise shall exceed -50dBm at all points.
 - j. Field Rate Sync Distortion: 5% maximum (FCC requirement).
 - k. Cross Modulation: -70dBm on fully loaded system.
 - l. K-Factor: 2% or better.
 - m. Adjacent Carriers: All adjacent channel carrier levels shall be within % 2dBm.
4. Documentation of Tests, Measurements, and Adjustments Performed:
- a. List of personnel and certified test equipment used.
 - b. The communications systems contractor shall provide manufacturer EIA and/or UL certification on all products installed under this contract.
 - c. Installer must certify in writing that the installation meets EIA 568/569 Specifications.
 - d. Contractor to provide standard one-year warranty beginning at substantial completion.
5. System Acceptance Test - Will not be performed until the communications system Contractor's Systems Checkout has been completed. The Systems Acceptance Test will consist of the following:
- a. A physical inventory shall be taken of all equipment on site and will be compared to equipment lists in the contractor documents.
 - b. The Contractor shall demonstrate the operation of all systems equipment.
 - c. Both subjective and objective tests will be required by the Owner to determine compliance with the specifications.
 - d. Final "as-built" drawings, manuals, and other required documents shall be on hand. Complete sets of these documents shall be delivered to the Engineer for review. Quantities to be coordinated with Division 1 requirements.
 - e. In the event further adjustment is required, or defective equipment must be repaired or replaced, test may be suspended or continued at the option of the Owner.

END OF SECTION

SECTION 27 1005
STRUCTURED CABLING FOR VOICE AND DATA - INSIDE-PLANT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Communications system design requirements.
- B. Communications pathways.
- C. Copper cable and terminations.
- D. Communications equipment room fittings.
- E. Communications outlets.
- F. Communications grounding and bonding.
- G. Communications identification.

1.02 RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping.
- B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
 - 1. Includes intersystem bonding termination.
 - 2. Includes bonding jumpers for bonding of communications systems and electrical system grounding.
- C. Section 26 0534 - Conduit.
- D. Section 26 0537 - Boxes.
- E. Section 26 0553 - Identification for Electrical Systems: Identification products.
- F. Section 26 2726 - Wiring Devices.

1.03 REFERENCE STANDARDS

- A. EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment; Electronic Industries Alliance/Electrical Components Association; Revision E, 2005.
- B. NECA/BICSI 568 - Standard for Installing Building Telecommunications Cabling; National Electrical Contractors Association; 2006.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2015.
- E. TIA-568-C.1 - Commercial Building Telecommunications Cabling Standard; Telecommunications Industry Association; Rev C, 2009 (with Addenda; 2012).
- F. TIA-568-C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards; Rev C, 2009 (with Addenda; 2014).
- G. TIA-569-C - Commercial Building Standard for Telecommunications Pathways and Spaces; Rev C, 2012 (with Addenda; 2013).
- H. TIA-606-B - Administration Standard for the Telecommunications Infrastructure; Rev B, 2012.
- I. TIA-607-B - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; Rev B, 2012 (with Addenda; 2013).
- J. UL 444 - Communications Cables; Current Edition, Including All Revisions.
- K. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.
- L. UL 1863 - Communications-Circuit Accessories; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate requirements for service entrance and entrance facilities with Communications Service Provider.
 - 2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.
 - 3. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 4. Notify Strategic Energy Solutions, Inc. of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
- C. Shop Drawings: Show compliance with requirements on isometric schematic diagram of network layout, showing cable routings, telecommunication closets, rack and enclosure layouts and locations, service entrance, and grounding, prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).
- D. Evidence of qualifications for installer.
- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.
- F. Field Test Reports.
- G. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of project record documents.

1.06 QUALITY ASSURANCE

- A. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- B. Manufacturer Qualifications: At least 3 years experience manufacturing products of the type specified.
- C. Installer Qualifications: A company having at least 3 years experience in the installation and testing of the type of system specified, and:
 - 1. Employing a BICSI Registered Communications Distribution Designer (RCDD).
 - 2. Supervisors and installers factory certified by manufacturers of products to be installed.
- D. Products: Listed, classified, and labeled as suitable for the purpose intended.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Keep stored products clean and dry.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Cabling and Equipment:
 - 1. Belden Inc.: www.belden.com
 - 2. Commscope: www.commscope.com
 - 3. Panduit: www.panduit.com

4. Siemon Company: www.siemon.com.

2.02 SYSTEM DESIGN

- A. Provide a complete permanent system of cabling and pathways for voice and data communications, including cables, conduits and wireways, pull wires, support structures, enclosures and cabinets, and outlets.
 1. Comply with TIA-568 (SET) (cabling) and TIA-569-C (pathways), latest editions (commercial standards).
 2. Provide fixed cables and pathways that comply with NFPA 70 and TIA-607-B and are UL listed or third party independent testing laboratory certified.
 3. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F at relative humidity of 0 to 95 percent, noncondensing.
 4. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.
- B. System Description:
 1. Offices and Work Areas: Provide two data outlets in each work area.
 2. Provide additional outlets where indicated on drawings.
- C. Main Distribution Frame (MDF): Centrally located support structure for terminating horizontal cables that extend to telecommunications outlets, functioning as point of presence to external service provider.
 1. Locate main distribution frame as indicated on the drawings.
 2. Capacity: As required to terminate all cables required by design criteria plus minimum 25 percent spare space.
- D. Cabling to Outlets: Specified horizontal cabling, wired in star topology to distribution frame located at center hub of star; also referred to as "links".

2.03 PATHWAYS

- A. Conduit: As specified in Section 26 0534; provide pull cords in all conduit.

2.04 COPPER CABLE AND TERMINATIONS

- A. Copper Horizontal Cable:
 1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568-C.2 and listed and labeled as complying with UL 444.
 2. Cable Type - Voice and Data: TIA-568-C.2 Category 6 UTP (unshielded twisted pair); 23 AWG.
 3. Cable Capacity: 4-pair.
 4. Cable Applications:
 - a. Plenum Applications: Use listed NFPA 70 Type CMP plenum cable.
 - b. Riser Applications: Use listed NFPA 70 Type CMR riser cable or Type CMP plenum cable.
 - c. General Purpose Applications: Use listed NFPA 70 Type CM/CMG general purpose cable, Type CMR riser cable, or Type CMP plenum cable.
 5. Cable Jacket Color -Communications Data Cable: Blue.
- B. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool; use screw connections only where specifically indicated.
- C. Jacks and Connectors: Modular RJ-45, non-keyed, terminated with 110-style insulation displacement connectors (IDC); high impact thermoplastic housing; suitable for and complying with same standard as specified horizontal cable; UL 1863 listed.
 1. Performance: 500 mating cycles.
 2. Data Jacks: 8-position modular jack, color-coded for both T568A and T568B wiring configurations.
- D. Copper Patch Cords:

1. Description: Factory-fabricated 4-pair cable assemblies with 8-position modular connectors terminated at each end.
2. Patch Cords for Patch Panels:
 - a. Quantity: One for each pair of patch panel ports.
 - b. Length: 36 inches.
3. Patch Cords for Work Areas:
 - a. Quantity: One for each work area outlet port.
 - b. Length: 10 feet.

2.05 COMMUNICATIONS EQUIPMENT ROOM FITTINGS

- A. Copper Cross-Connection Equipment:
 1. Patch Panels for Copper Cabling: Sized to fit EIA/ECA-310 standard 19 inch wide equipment racks; 0.09 inch thick aluminum; cabling terminated on Type 110 insulation displacement connectors; printed circuit board interface.
 - a. Jacks: Non-keyed RJ-45, suitable for and complying with same standard as cable to be terminated; maximum 48 ports per standard width panel.
 - b. Capacity: Provide ports sufficient for cables to be terminated plus 25 percent spare.
 - c. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606-B.
 - d. Provide incoming cable strain relief and routing guides on back of panel.
- B. Backboards: Interior grade plywood without voids, 3/4 inch thick; UL-labeled fire-retardant.
 1. Do not paint over UL label.
- C. Equipment Racks and Cabinets: EIA/ECA-310 standard 19 inch wide component racks.
 1. Floor Mounted Racks: Aluminum or steel construction with corrosion resistant finish; vertical and horizontal cable management channels, top and bottom cable troughs, and grounding lug.
 2. Freestanding Cabinets: Front and rear doors with locks; removable side panels with locks; vented top and rear door; adjustable leveling feet; cable access in roof and base; grounding bar.
 3. Cabinets: Steel construction with corrosion resistant finish.
 4. Locks: Keyed alike.

2.06 COMMUNICATIONS OUTLETS

- A. Outlet Boxes: Comply with Section 26 0537.
 1. Provide depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.
 2. Minimum Size, Unless Otherwise Indicated:
 - a. Data or Combination Voice/Data Outlets: 4 inch square by 2-1/8 inch deep (100 by 54 mm) trade size.
- B. Wall Plates:
 1. Comply with system design standards and UL 514C.
 2. Accepts modular jacks/inserts.
 3. Capacity:
 - a. Data or Combination Voice/Data Outlets: 4 ports.
 4. Wall Plate Material/Finish - Flush-Mounted Outlets: Match wiring device and wall plate finishes specified in Section 26 2726.

2.07 GROUNDING AND BONDING COMPONENTS

- A. Comply with TIA-607-B.

2.08 IDENTIFICATION PRODUCTS

- A. Comply with TIA-606-B.

2.09 SOURCE QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Factory test cables according to TIA-568.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

- A. Comply with latest editions and addenda of TIA-568 (SET) (cabling), TIA-569-C (pathways), TIA-607-B (grounding and bonding), NECA/BICSI 568, NFPA 70, and SYSTEM DESIGN as specified in PART 2.
- B. Comply with Communication Service Provider requirements.
- C. Grounding and Bonding: Perform in accordance with TIA-607-B and NFPA 70.
- D. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

3.02 INSTALLATION OF PATHWAYS

- A. Install pathways with the following minimum clearances:
 - 1. 48 inches from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.
 - 2. 12 inches from power conduits and cables and panelboards.
 - 3. 5 inches from fluorescent and high frequency lighting fixtures.
 - 4. 6 inches from flues, hot water pipes, and steam pipes.
- B. Conduit, in Addition to Requirements of Section 26 0534:
 - 1. Arrange conduit to provide no more than the equivalent of two 90 degree bend(s) between pull points.
 - 2. Conduit Bends: Inside radius not less than 10 times conduit internal diameter.
 - 3. Arrange conduit to provide no more than 100 feet between pull points.
- C. Outlet Boxes:
 - 1. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of telecommunications outlets provided under this section.
 - a. Mounting Heights: Unless otherwise indicated, as follows:
 - 1) Telephone and Data Outlets: 18 inches above finished floor.
 - b. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
 - c. Provide minimum of 24 inches horizontal separation between flush mounted outlet boxes installed on opposite sides of fire rated walls.
 - d. Unless otherwise indicated, provide separate outlet boxes for line voltage and low voltage devices.
 - e. Locate outlet boxes so that wall plate does not span different building finishes.
 - f. Locate outlet boxes so that wall plate does not cross masonry joints.

3.03 INSTALLATION OF EQUIPMENT AND CABLING

- A. Cabling:
 - 1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
 - 2. Do not over-cinch or crush cables.
 - 3. Do not exceed manufacturer's recommended cable pull tension.
 - 4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.
- B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:
 - 1. At Distribution Frames: 120 inches.

2. At Outlets - Copper: 12 inches.
- C. Copper Cabling:
 1. Category 5e and Above: Maintain cable geometry; do not untwist more than 1/2 inch from point of termination.
 2. For 4-pair cables in conduit, do not exceed 25 pounds pull tension.
 3. Use T568B wiring configuration.
- D. Floor-Mounted Racks and Enclosures: Permanently anchor to floor in accordance with manufacturer's recommendations.
- E. Identification:
 1. Use wire and cable markers to identify cables at each end.
 2. Use manufacturer-furnished label inserts, identification labels, or engraved wallplate to identify each jack at communications outlets with unique identifier.
 3. Use identification nameplate to identify cross-connection equipment, equipment racks, and cabinets.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Comply with inspection and testing requirements of specified installation standards.
- C. Visual Inspection:
 1. Inspect cable jackets for certification markings.
 2. Inspect cable terminations for color coded labels of proper type.
 3. Inspect outlet plates and patch panels for complete labels.
- D. Testing - Copper Cabling and Associated Equipment:
 1. Test operation of shorting bars in connection blocks.
 2. Category 5e and Above Links: Perform tests for wire map, length, attenuation, NEXT, and propagation delay.
- E. Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone.

END OF SECTION

SECTION 27 1101
COMMUNICATIONS EQUIPMENT SPACES SUPPORT HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Equipment Shelves
- B. Equipment Racks
- C. Cable management
- D. Backboards
- E. Tie-wraps
- F. D-rings
- G. T-posts

1.02 RELATED SECTIONS

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this section.
- B. Provide all items, articles, materials, operations or methods listed, mentioned or scheduled on drawings and/or herein, including all labor, materials, equipment and incidentals necessary and required for their completion.
- C. The items in this section are supplementary to the requirements set forth in other portions of the specifications as indicated under Item "A" above.
- D. Division 1, Section 01300 "Submittals" requirements apply to this section and will require the Contractors participation in the Above Ceiling Coordination Program.

1.03 REFERENCES

- A. ANSI/NFPA 70 National Electrical Code
- B. NFPA-75 Protection of Electronic Computer Data Processing Equipment
- C. NFPA-297 Guide on Principles and Practices for communication systems
- D. ANSI/TIA/EIA 568-A Commercial Building Telecommunications Cabling Standard
- E. ANSI/TIA/EIA 569-A Commercial Building Standard for Telecommunications Pathways and Spaces
- F. ANSI/TIA/EIA 607 Commercial Building Grounding and Bonding Requirements for Telecommunications

1.04 DRAWINGS

- A. The drawings show the location and general arrangement of equipment, electrical systems and related items. They shall be followed as closely as elements of the construction will permit.
- B. Examine the drawings of other trades and verify the conditions governing the work on the job site. Arrange work accordingly, providing such fittings, conduit, junction boxes and accessories as may be required to meet such conditions.
- C. Deviations from the drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect.
- D. The architectural and structural drawings take precedence in all matters pertaining to the building structure, mechanical drawings in all matters pertaining to mechanical trades and electrical drawings in all matters pertaining to electrical trades. Where there are conflicts or differences between the drawings for the various trades, report such conflicts or differences to the Architect for resolution.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

1.06 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 26 0501.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.
- C. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

1.08 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver, store, protect, and handle Products to site under provisions of Section 26 0500.
- B. Protect products from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.09 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Verify routing and termination locations of conduits, and cable pathways prior to rough-in.
- C. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.10 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 WALL MOUNTED EQUIPMENT RACKS

- A. Manufacturers:
 - 1. Great Lakes Case and Cabinet Company.
 - 2. APW.
 - 3. B-Line.
 - 4. Hubbell.
- B. Description: Wall mounted rack, nominal 19" x 48" H, or 19" x 84"H, as indicated on Drawings.
- C. Material: Equivalent construction as floor mounted rack, with steel hinge and mounting hardware.
- D. Finish: Telco gray powder coat.
- E. Width: Nominal 22 inches.
- F. Depth: Nominal 24 inches projection from wall.
- G. Height: Nominal 48 inches.
- H. Provide two (2) equipment shelves and all mounting hardware.
- I. Provide complete ground bar kit with all required hardware.
- J. Provide power plug strip with a minimum of 6 surge-protected outlets in cabinet and 10 foot cord.

PART 3 EXECUTION

3.01 EQUIPMENT RACKS

- A. Contractor shall furnish and install wall mounted and floor-mounted equipment racks per manufacturers recommendation.
- B. Provide equipment racks of same type, style and finish color as existing, where applicable.
- C. Contractor shall permanently install an engraved laminated, phenolic designation plate on each data/telecommunication rack. The plate shall be white with black letters. Helvetica letter heights shall be 3/8"
- D. The racks shall be labeled according to the Drawings and in accordance with specification 17170 "Cable Plant Administration and Testing"
- E. All racks, cabinets and cable transport hardware shall be bonded to the communications system ground riser .

3.02 BACKBOARDS

- A. A minimum, 4" W x 8" H x 3/4", fire retardant plywood backboard shall be supplied in the Telecommunications spaces as indicated on Drawings.
- B. Paint backboard with two coats of fire retardant paint on all sides, white in color
- C. Securely fasten backboard to wall using appropriate hardware and mount at all four corners, minimum.
- D. Provide adequate backboard space to allow a clean and workable arrangement for telephone and data connections.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.04 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 4000.

END OF SECTION

**SECTION 28 3101
FIRE ALARM SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire alarm control panels.
- B. Remote annunciator panels.
- C. Alarm initiating devices.
- D. Fire alarm signaling appliances.
- E. Auxiliary devices.
- F. Conduit and wire.

1.02 RELATED SECTIONS

- A. Section 013000 - Administrative Requirements.
- B. Section 016000 - Product Requirements.
- C. Section 017000 - Execution Requirements.
- D. Section 081000 - Doors and Frames.
- E. Section 087100 - Door Hardware.
- F. Section 211300 - Fire Suppression Sprinklers.
- G. Section 233300 - Ductwork Accessories; Smoke Dampers.
- H. Section 260519 - Low-Voltage Electrical Power Conductors and Cables

1.03 REFERENCES

- A. UL 864 9th Edition.
- B. NFPA 70 - National Electrical Code 2008.
- C. NFPA 72 - National Fire Alarm Code 2008.
 - 1. NFPA 72A- Installation, Maintenance, and Use of Local Protective Signaling System for Tour, Fire Alarm, and Supervisory Service.
 - 2. NFPA 72B- Installation, Maintenance, and Use of Auxiliary Protective Signaling System for Fire Alarm Service.
 - 3. NFPA 72C- Installation, Maintenance, and Use of Remote Station Protective Signaling System.
 - 4. NFPA 72E- Automatic Fire Detectors.
 - 5. NFPA 72G- Notification Appliances for Protective Signaling Systems.
 - 6. NFPA 72H- Guide to Test Procedures for Protective Signaling Systems.
- D. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures 2008.

1.04 SYSTEM DESCRIPTION

- A. Fire Alarm System: NFPA 72A; automatic addressable fire alarm system.
 - 1. Fire Alarm System: Micro-processor based control system suitable for use as a local fire alarm system with releasing device service using automatic and manual initiating devices.
 - a. LCD display to indicate all information associated with the Fire Alarm condition, including type of alarm and location within the protected premise.
 - b. Non-volatile history buffer to log time and date of each occurrence, large enough to log all potential alarms without losing any alarm initiations.
 - c. All control functions activated within three seconds after receipt of alarm condition.
 - d. All components UL Listed and/or FM approved for the intended application.
- B. System Supervision: Provide electrically supervised system, with supervised alarm initiating and alarm signaling circuits. Occurrence of single ground or open condition in initiating or

signaling circuit places circuit in TROUBLE mode. of single ground or open condition on alarm initiating or signaling circuit does not disable that circuit from transmitting in ALARM.

- C. Alarm Sequence of Operation: Actuation of manual fire alarm station or automatic initiating device causes system to enter ALARM, which includes the following operations:
 - 1. Sound and display local fire alarm signaling devices with non-coded signal.
 - 2. Indicate location of alarm condition on fire alarm control panel and on remote annunciator panel.
 - 3. Transmit signal to building mechanical systems to initiate shutdown of fans and damper operation.
 - 4. Transmit signal to release door hold-open devices.
 - 5. Record in non-volatile memory, the of the event, time and date, and the device initiating the alarm condition.
- D. Alarm Reset: Key accessible RESET function resets alarm system out of ALARM if alarm initiating circuits have cleared.
- E. Trouble Sequence of Operation: System trouble, including grounding or open circuit of supervised circuits, or power or system failure causes system to enter TROUBLE mode, including the following operations:
 - 1. Visual and audible trouble alarm by zone at control panel.
 - 2. Visual and audible trouble alarm at annunciator panel.
 - 3. Manual ACKNOWLEDGE function at control panel silences audible trouble alarm; visual alarm is displayed until initiating trouble is cleared.
- F. Lamp Test: Manual LAMP TEST function causes alarm indication at each zone at fire alarm control panel and at annunciator panel.
- G. Drill Sequence of Operation: Manual DRILL function causes ALARM mode operation to:
 - 1. Sound and display local fire alarm signaling devices.
 - 2. Indicate location of alarm zone on fire alarm control panel and on remote annunciator panel.
- H. The fire alarm system shall comply with UL 864 9th edition.

1.05 SYSTEM FUNCTION

- A. The system shall be a complete, electrically supervised fire detection and evacuation system with microprocessor based operating system having the following capabilities, features and capacities.
- B. Communication between a minimum of thirty-six network connected, interactive, self-standing, intelligent local control panels.
 - 1. Each network connected local control panel shall have the capacity to supervise and annunciate up to the maximum number of devices as listed for the signaling line circuit (SLC) classification and style number as defined by NFPA 72.
 - 2. Analog addressable detection circuits shall be class B selectable style 4 wiring with a minimum of sixty addresses.
 - 3. Smoke detectors shall be interrogated for sensitivity level from the local control panel and logged for sensitivity changes indicating the requirement for cleaning.
 - 4. Sensitivity settings of individual detectors shall be adjustable manually from the local control panel to reduce incidence of false alarms caused by environmental conditions.
 - 5. The system shall support analog smoke detection, conventional smoke detection, manual station, water flow switches, tamper switches and status monitoring devices. The local control panel shall be UL listed as a test instrument for the measurement and logging of the sensitivity of connected intelligent devices.
 - 6. Any intelligent analog smoke detector shall include a selectable alarm verification capability.

7. The system shall have the capability of logging to historical memory, the time and date of all events or unverified alarm conditions in order to track activity and generate maintenance reports.
- C. All external circuits shall be listed as power limited circuits per article 760 of the National Electric Code.
- D. Each circuit interface panel shall be capable of operating in its own degrade mode. In this mode, the system shall receive an alarm from any intelligent analog or conventional initiating device. It shall activate local indicating appliances and remote or auxiliary connected circuits.
- E. The system shall be capable of time based control functions including automatic changes in specified smoke detector sensitivity ratings.
- F. The system shall have the capability of being tested by one person at the control panel.
- G. The system shall be programmed in the field either from the panel or with a laptop computer. All programmed information will be stored in nonvolatile memory after loading into the control panel. During program reading or loading, the system shall retain the capability of alarm reporting.
- H. The local system shall consist of a central or distributed multiplex architecture using a centrally located control unit with interconnection to remote circuit interface panels containing any combination of pluggable intelligent analog signalling circuits, plug in conventional initiating device circuits and plug-in relays.
- I. The local control panel shall provide status indicators for the following functions as applicable.
 1. Audible and visual evacuation alarm circuit zone control.
 2. Status indicators for sprinkling system waterflows and valve supervisory devices.
 3. Status indicators for generator running, generator fault, generator switch in nonautomatic position, and generator low fuel.
- J. The system and associated batteries shall have the capacity to add 20% additional alarm devices.

1.06 SUBMITTALS

- A. Submit shop drawings and product data sheets under provisions of Section 260500.
- B. References to manufacturer's model numbers and other pertinent information herein establishing minimum standards of performance, function, and quality.
 1. Equivalent equipment from other manufacturers that meet minimum standards may be substituted for the specified equipment.
 2. For equipment other than specified, submit proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.
- C. Product Data Sheets: Material and equipment information including manufacturer's catalog data sheets and pertinent technical data for each component or device used on the system, including the following:
 1. Control panel.
 2. Analog smoke sensors.
 3. Manual discharge stations.
 4. Abort stations.
 5. Contact monitoring devices.
 6. Releasing Devices.
 7. Addressable relays.
 8. Addressable supervised output modules.
 9. Graphic annunciators.
- D. Shop Drawings:
 1. Sufficient information, clearly presented, to determine compliance with drawings and specifications.

2. Include manufacturer's name, model numbers, ratings, power requirements, equipment layout, device arrangement, complete point-to-point wiring diagrams, and conduit layout.
 3. Include complete sequence of operation for all control functions provided by the fire alarm control panel.
 4. Show annunciator layout, configuration, and terminations.
 5. Marked up copies of the bid documents is not acceptable for shop drawings.
- E. Manufacturer's Installation Instructions:
1. Submit simultaneously with shop drawings, complete operating and maintenance manual.
 2. Indicate application conditions and limitations of use stipulated by product testing agency.
- F. Submit complete shop drawings to the State Fire Marshal for review and approval. Include all fees in original bid.

1.07 PROJECT RECORD DOCUMENTS

- A. Submit under the provisions of Section 017000.
- B. Submit four copies of record drawings showing the locations of fire alarm devices and appliances, the locations of end-of-line resistors and junction boxes, the addresses of addressable devices, the tap settings of audible notification appliances, the intensity ratings of visual notification appliances, the sizes of conduits and conductors, circuit numbers, and deviations from the design.
- C. Submit four printed copies of the final system configuration list showing inputs, outputs, addresses, custom location labels, device configurations and program logic.
- D. Record actual wiring terminations.
- E. Submit one copy of the final system software suitable for use by the Owner on a Windows based computer.
1. The master program generic to the model of system being provided.
 2. The building specific program containing the unique information for the system being provided.
 3. A software license and the system passwords required by the Owner to perform programming changes.

1.08 OPERATION AND MAINTENANCE DATA

- A. Submit under the provisions of Section 017000.
- B. Provide operating instructions and maintenance procedures.
- C. After installation, include manufacturer representative's letter stating that the system is operational.

1.09 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
1. Company specializing in manufacturing the products specified in this section for at least ten years.
 2. Name of manufacturer, part number, and serial number shall appear on all major components.
 3. All devices, components, and equipment shall be the products of a single manufacturer.
 4. All devices, components, and equipment shall be new and standard products of the manufacturer's latest design, suitable to perform the functions intended.
- B. Installer's Qualifications:
1. Firm regularly engaged in installation of systems similar to those specified in this section with five years minimum experience in design, installation, testing, and service of fire detection and control systems.
 2. Trained and certified by the manufacturer to design, install, test, and service the fire detection and control system provided under this section.

3. Employ a NICET certified fire alarm system designer, level 2 or above, who will be responsible for this project.
 4. Show evidence of a minimum two million dollar liability and completed operations insurance policy. These limits supersede limits required elsewhere in this specification.
 5. Provide proof of emergency service available 24 hours a day, seven days a week.
- C. Regulatory Requirements:
1. System shall conform to the requirements of NFPA 70, NFPA 72, and NFPA 101.
 2. Furnish products listed and classified by Underwriters Laboratories Inc. and/or Factory Mutual Research Corporation as suitable for the purpose specified and indicated.
 3. System shall conform to the requirements acceptable to the authority having jurisdiction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers:
1. Siemens Building Technology, Telephone (973) 593-2600
 2. EST- Edwards Systems Technology, Telephone (586) 247-5356
 3. National Time and Signal, Telephone (248) 380-6264
 4. Notifier Fire Systems, Telephone (203) 484-7161
 5. Gamewell -FCI, Telephone (248) 328-000 (IQ Life Safety)
- B. Provide all fire alarm systems from a single manufacturer.

2.02 FIRE ALARM CONTROL PANEL (FACP)

- A. Control Panel: Modular construction with surface wall mounted enclosure.
- B. Detection Circuits: Supervised non-coded signal module, sufficient for signal devices connected to the system, plus 20% spare capacity.
- C. Remote Station Signal Transmitter: Electrically supervised, capable of transmitting alarm and trouble signals over telephone lines to remote station receiver.
- D. Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts to provide accessory functions specified.
- E. Provide TROUBLE ACKNOWLEDGE, DRILL, and ALARM SILENCE switch.
- F. FACP: Micro-processor based system capable of communicating with smoke sensors, thermal sensors, contact monitoring modules, addressable supervised output modules, addressable releasing modules, and addressable relay modules.
- G. System Capacity and General Operation:
1. System capable of communicating and controlling up to 508 addressable analog devices and sensors; system supporting up to 240 software zones for configuring initiating devices and output functions.
 2. System shall respond to an alarm initiating device, including analog smoke sensors, within 3 seconds for a fully loaded system (508 devices); response times measured from activation of initiating device to activation of associated notification appliance circuit.
 3. System shall provide an Alarm, Trouble and Supervisory Form-C Relay contact rated 2.0 amps minimum at 30 VDC.
 4. System shall provide two configurable notification appliance circuits at the FACP, each circuit rated 2.0 amps at 24 VDC.
 5. FACP shall include a full featured operator interface control and annunciation panel that includes a LCD display, individual color coded system status LED's, and an alpha-numeric keypad for field programming of the fire alarm system.
 6. Programming or editing of the existing configuration program in the system shall not require use of special equipment, such as a laptop personal computer. Access to the configuration program shall be limited by use of a password security system; three levels of access shall be used to isolate user, maintenance, and configuration operating portions of the system.

7. FACP shall provide the following features:
 - a. Drift compensation for analog sensors.
 - b. Sensitivity test in accordance with NFPA 72 requirements.
 - c. Maintenance alert for sensors with excessive accumulations of dust or dirt.
 - d. Alarm verification with individual counters for each sensor.
 - e. Periodic calibration of smoke sensors.
 - f. Day/Night automatic smoke sensor sensitivity adjustments.
 - g. One man walk test with optional notification appliance testing.
 - h. Two levels of adjustable pre-alarm for advanced warning.
 - i. 1800 event history buffer, with dedicated 600 event alarm event buffer.
- H. Central Microprocessor:
 1. Central microprocessor shall communicate, control, and monitor all external devices; custom operating parameters for the system stored in non-volatile memory to prevent loss during power outages.
 2. Provide real time clock to denote actual time of occurrence of system events for the display, history buffers, and external reporting devices.
- I. Display:
 1. LCD display shall annunciate system conditions and program system operating parameters.
 2. Provide eight status LED's: AC Power, Fire Alarm, Pre-Alarm Warning, Supervisory, Trouble, Alarm Silence, Supervisory Silence, and Trouble Silence
 3. Display unit shall provide a 25 key-pad with tactile feel membrane switches which provide operational feedback. Separate keys shall be dedicated to System Reset, Step, Alarm Silence, Acknowledge, and Drill. Key-pad shall be used to provide all control and programming functions for the system.
- J. Signaling Line Circuits (SLC):
 1. Each SLC shall provide power and communication with up to 127 analog or addressable devices; basic system shall consist of two SLC (254 devices total) with expansion to four SLC (508 devices total). Each SLC shall be capable of meeting wiring requirements of NFPA 72, Style 4, 6 and 7.
 2. Each SLC shall communicate using a completely digital communication method, providing a more reliable, noise immune communication system. Communication between an addressable device or sensor shall use a validation method, such as providing a checksum for each message, to validate the integrity of each message; systems which use a hybrid analog and digital communication scheme will not meet the requirements of this section.
 3. Each SLC shall use an Interrupt driven communication scheme to rapidly identify alarm conditions of any connected device. Normal polling scheme of the system shall be interrupted by a device in alarm. Identification of alarming device shall be annunciated at the control system display within 2 seconds of activation.
 4. Control devices shall maintain local operating parameters and not require individual commands from the control system to activate.
 5. System shall meet NFPA 72 requirements as a calibrated smoke sensitivity fixture.
- K. Enclosures:
 1. System shall be housed in a small footprint enclosure with dimensions not to exceed 22 inches by 14.75 inches by 4.5 inches.
 2. Enclosures capable of surface or semi-flush mounting without requiring additional hardware.
 3. Enclosures painted either red or gray with a corrosion protective, hardened finish.
- L. Power Supplies:
 1. Power Supply: Adequate to serve control panel modules, remote detectors, remote annunciators, door holders, relays, and alarm signaling devices. Include battery operated

- emergency power supply with capacity for operating system in standby mode for 24 hours followed by alarm mode for 5 minutes.
2. Power supply shall operate upon either 120 VAC, 60 Hertz, providing all power necessary to operate the control system.
 3. Power supply shall provide 5.0 amps of power for use on notification appliance circuits or auxiliary power circuits.
 4. Provide capability to supply an additional 5.0 amps of power, bringing total output power capacity to 10.0 amps at 24 VDC.
 5. Each power supply shall provide battery charger capacity to sufficiently recharge a depleted set of 17 AH batteries within 48 hours.
 6. Provide auxiliary power output circuits for four wire detectors or addressable control modules. Provide separate circuit to allow resetting the auxiliary power during a system reset. All auxiliary power circuits shall be power limited.
- M. Field Programming:
1. Programming shall be accomplished via the standard 25 key-pad.
 2. Provide two levels of password access to prevent unauthorized modifications to the system operating configuration. Within each access level, up to 16 unique users can be assigned. The history buffer will record the user for each action taken requiring a password.
 3. Provide a Learn Mode to identify changes in the installed system with the system configuration. Identified changes will then be presented to the user for validation. The Learn Mode shall also provide a means to program groups of devices with the same operating characteristics to minimize configuration times and errors.

2.03 REMOTE ANNUNCIATOR PANEL

- A. Separate location for the annunciation of ALARM, SUPERVISORY, TROUBLE, and MONITOR operations. Annunciation must be through the use of both LED display strips complete with a means to custom label each LED as to its function, and an LCD display with basic common control switches and LED's. Common control switches and LED's provided as a minimum shall be: RESET, ALARM SILENCE, PANEL SILENCE and DRILL.
- B. It shall be possible to add additional common controls as required through the use of modular display/control units.
- C. The LCD interface shall provide the ability to display custom event messages of up to 42 characters. The LCD interface shall provide the emergency user, hands free viewing of the first and last highest priority events.
- D. The panel shall be able to be both surface and semi-flush mounting with no additional hardware.
- E. Cabinet shall allow both LED and LCD annunciation in a single enclosure.
- F. Control/Display modules install over any annunciator support module maximizing annunciator design flexibility.

2.04 ALARM INITIATING DEVICES

- A. Intelligent/analog and non-addressable ionization, photoelectric and thermal detectors shall be capable of being intermixed on the same control panel. All detection devices shall contain an integral alarm LED. All intelligent/analog detectors shall be individually identifiable from the control panel.
- B. It shall be possible to adjust the sensitivity of each individual intelligent/analog photoelectric detector from the control panel.
- C. Spot detector mounting bases shall be individually addressable, suitable for two wire operation, with a twist-lock head locking feature, a DIP switch addressing means, an LED that provides power "on", alarm and trouble indications, a magnetically actuated test switch for easy testing. The bases shall be listed for ceiling and wall mounting. Removal of the detector head shall

cause a trouble condition at the panel. Pigtails or in-line connectors shall not be permitted. It shall be possible to secure the detector in the base with a concealed locking mechanism to prevent unauthorized removal. Detector removal shall require a special unlocking tool.

D. Addressable Photoelectric Smoke Detector:

1. Shall be listed by Underwriters Laboratories, Inc. The detector shall contain a long life light emitting diode (LED) as its light source, and photo diode as a light receiver. An automatic gain control circuit shall be provided to maintain correct sensitivity by compensating for detector aging and dirt accumulation.
2. Shall provide complete supervision of the detector optics. The detector shall be supervised for complete failure of the LED light source or a critical reduction in the light output of the LED caused by excessive dirt which could not normally be compensated for by the automatic gain control circuit.
3. Shall include pulsed LED light source and a silicon photodiode receiver, seven levels of sensitivity selectable at the panel, and 360 degree smoke entry.
4. Shall store the sensor address and operating characteristics in non-volatile memory at the sensor. Sensor shall use a threshold received from the control unit to determine when an alarm condition exists.
5. Shall have two alarm LED's for 360 degree viewing. The alarm LED's shall flash when communicating with the control panel and shall illuminate steady during alarm conditions.
6. Sensitivity settings for photoelectric sensors shall be set and displayed on the LCD in percent obscuration per foot.
7. A calibrated light source shall be used to calibrate the fire level of the photoelectric sensor. Sensors which use a fixed fire level limit are not acceptable.

E. Addressable Thermal Detectors:

1. Shall be of the rate compensated, fixed temperature type and shall be listed by Underwriters Laboratories, Inc. The detectors shall be individually annunciated on the control panel. The detectors shall contain an integral alarm lamp.
2. Shall store the sensor address and operating characteristics in non-volatile memory at the sensor; sensor shall use a threshold received from the control unit to determine when an alarm condition exists.
3. Shall have two alarm LED's for 360 degree viewing. The alarm LED's shall flash when communicating with the control panel and shall illuminate steady during alarm conditions.
4. Sensitivity settings for thermal detectors shall be set and displayed on the LCD in degrees fahrenheit. The set point for the thermal sensor shall be adjustable between 100 degrees and 156 degrees F. The thermal detector shall operate on a fixed temperature principle.

F. Single Station Smoke Alarm:

1. Single station stand-alone detectors with audio and visual signal upon detection of smoke. Provide dual power 120 volt and 12 volt battery.

G. Duct Detectors:

1. Shall be listed by Underwriters Laboratories, Inc. The detector shall operate on a cross-sectional air sampling principle to overcome stratification and the skin effect. The detector shall consist of a standard intelligent/analog ionization detector mounted in an air duct sampling assembly and sampling tube that protrudes across the duct of the ventilation system.
2. Shall be individually addressable and consist of a housing, sampling tubes, a baffle and a detachable detector head.
3. Shall retain the features of the intelligent/analog photoelectric detector, and be installed in the ventilating duct as indicated in the manufacturer's instructions.
4. Shall include an alarm LED, a local test switch, and an auxiliary SPDT relay for ventilation system control.
5. Shall be suitable for four wire operation by utilizing 24 volt DC power from the panel, and shall be resettable by actuating the panel reset pushbutton.
6. The sampling tubes shall be capable of being cleaned through the housing cover.

- H. Addressable Manual Pull Stations
 1. Shall be listed by Underwriters Laboratories, Inc. The station shall be non-coded and shall operate on any addressable detection circuit, and shall be individually annunciated on the control panel.
 2. Shall be individually addressable, suitable for two wire operation, with a high impact red Lexan body and raised white lettering, a DIP switch addressing means, and a single action operating mechanism with a mechanical latch to hold an operated station open until unlocked with a key common to the panel.
- I. Addressable Interface Module:
 1. Shall be listed by Underwriters Laboratories, Inc. The unit shall incorporate a custom microprocessor based integrated circuit which shall provide communication with the control panel. The unit shall supervise and monitor normally open or normally closed dry contacts. The unit shall report the status to the control panel. The unit shall be dynamically supervised and uniquely identifiable by the control panel. The unit shall be used to uniquely identify all water flow switches and tamper switches.
 - a. Water Flow Switches: The water flow switches shall be provided by the mechanical contractor and wired by the electrical contractor. The switches shall be connected to the fire alarm system through the use of addressable interface modules.
 - b. Tamper Switches: The tamper switches shall be provided by the mechanical contractor and wired by the electrical contractor. The switches shall be connected to the fire alarm system through the use of addressable interface modules.

2.05 PERIPHERAL FIRE ALARM EQUIPMENT

- A. Fast Response Contact Module:
 1. Contact modules shall provide monitoring of dry contacts as initiating devices.
 2. Each module shall store the sensor address and operating characteristics in non-volatile memory at the module.
 3. Mount module to a standard junction box and provide visual indication of status via a status LED. Optional mounting shall be available to allowing mounting the module in a junction box with a monitored contact.
- B. Supervised Output Module:
 1. Each supervised output module shall be rated to operate listed notification appliances.
 2. Circuit shall be rated for 2.0 amps at 24 VDC.
 3. Each module shall store the sensor address and operating characteristics in non-volatile memory at the module.
 4. Each module shall be individually selectable for silencing and walktest. A module programmed to operate during walktest will initiate the programmed pattern for 4 seconds when the appropriate initiating conditions are satisfied.
 5. Each module shall operate under up to 16 different conditions occurring in the system. These conditions include combining various zones and zone states.
- C. Solenoid Releasing Module:
 1. Circuit shall be rated for 2.0 amps at 24 VDC.
 2. Each module shall store the sensor address and operating characteristics in non-volatile memory at the module.
 3. Module shall be capable of actuating a listed solenoid or an Agent Release Circuit.
 4. Module shall be protected from false actuation by a intelligent transistor.
- D. Dual Relay Module:
 1. Module shall provide two independently operating and configurable relays.
 2. Each relay shall be rated for 2.0 amps at 24 VDC.
 3. Each module shall store the sensor address and operating characteristics in non-volatile memory at the module.
 4. Each module shall operate under up to 16 different conditions occurring in the system. These conditions include combining various zones and zone states.

5. Module shall operate both relays without requiring a separate power source.

2.06 FIRE ALARM SIGNALING APPLIANCES

- A. Strobes: Meeting requirements of NFPA/ANSI standards and ADA Accessibility Guidelines.
 1. Strobes shall be rated 24 volts DC, with candela ratings as indicated on the plans with a 1 Hertz flash rate Xenon flash tube, red body, clear Lexan lens with white 'FIRE' lettering, and capable of wall or ceiling mounted.
 2. All strobes shall be synchronized.
- B. Horns:
 1. Horns shall be electric, rated at 24 volts DC, with a piezoelectric driver capable of producing 8 field selectable tones, set to produce a slow whoop sound level of 101 dBA at 10 feet with a current draw of 36 milliamps, with a red, semi-flush body with white 'FIRE' lettering, and capable of wall or ceiling mounting.
- C. Speakers:
 1. Speakers shall be rated 24 volts RMS, 125 to 12,000 Hertz, with four taps rated at from 1/4 to two watts, set at the 1/2 watt tap to produce a sound level of 82 dBA at 10 feet, with a semi-flush body capable of wall or ceiling mounting.
- D. Combination Horn/Strobes and Speaker/Strobes:
 1. Combination horn/strobes and speaker/strobes shall consist of the horns, speakers and strobes as specified above, but combined on a single mounting plate/housing.
- E. Alarm Bells:
 1. Alarm Bells shall be rated 24 volts DC, fully enclosed and dustproof. They shall be designed to be mounted on a wall, ceiling or other suitable rigid surface that is free from vibration. The alarm bells shall be UL listed.

2.07 AUXILIARY DEVICES

- A. Door Release: Magnetic door holder with integral diodes to reduce buzzing, 24 volt DC.

2.08 CONDUIT AND WIRE

- A. Conduit:
 1. Install conduit in accordance with the National Electrical Code, NFPA 70.
 2. Install all wiring in a conduit or raceway. Conduit fill shall not exceed 40 percent of the interior cross sectional area where three or more cables are included within a single conduit.
 3. Separate cables from any open conductors of Class 1 circuits and do not place in any conduit, junction box, or raceway containing Class 1 cables.
 4. Wiring for low voltage control, alarm notification, emergency communication, and similar power-limited auxiliary functions may be installed in the same conduit as initiating and signaling line circuits. Design system to permit simultaneous operation of all circuits without interference or loss of signals.
 5. Conduits shall not enter the control panel or any other component provided except where entry is specified by the manufacturer.
 6. Conduit shall be 3/4 inch minimum.
 7. All conduit for fire alarm wiring shall be painted by the manufacturer, color shall be red.
 - a. Approved manufacturer of fire alarm conduit: Allied Tube & Conduit "True Color EMT"
- B. Wire:
 1. All fire alarm system wiring shall be new, plenum rated where required.
 2. All cabling installed in open ceiling spaces shall be type FPLP, low smoke, fire resistant, metal clad cable, with red coloring. Cabling shall be per manufacturer's recommendation, and shall be able to power the strobes and horn/strobes together, or independently.
 3. Wiring shall comply with local, state, and national codes and as recommended by the manufacturer. Number and size of conductors shall be as recommended by the

- manufacturer, but shall be not less than 18 AWG for initiating device and signaling line circuits, and 14 AWG for notification appliance circuits.
4. All wiring and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
 5. All field wiring shall be supervised for open circuits, short circuits, and grounded conditions.
- C. Control Panel: Connected to a separate dedicated branch circuit with a separate dedicated disconnect switch; circuit labeled FIRE ALARM.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Control and other panels shall be mounted with sufficient clearance for observation and testing.
- C. All fire alarm junction boxes must be clearly marked for easy identification.
- D. Flexible connectors shall be used for all devices mounted in suspended lay-in ceiling panels.
- E. All conduit, mounting boxes, junction boxes and panels shall be securely hung and fastened with appropriate fittings to insure positive grounding throughout the entire system.
- F. Smoke and heat detectors shall not be installed until after the construction clean-up is completed. Detectors installed prior to clean-up shall be cleaned by the manufacturer or replaced.
- G. Pull stations and horns installed in finished areas shall be mounted semi-flush and may be surface mounted on a recess mounted junction box in non-finished areas. Smoke detectors and thermal detectors shall be mounted on a recess mounted junction box in finished areas and to surface mounted junction boxes in non-finished areas.
- H. Install manual stations with operating handle 4 feet above floor. Install audible and visual signal devices 6 feet 8 inches above the floor, or 6 inches below the ceiling, whichever is lower.
- I. Use 16 AWG minimum size conductors for fire alarm detection and signal circuit conductors. Install wiring in conduit. All wiring shall be per manufacturer's requirements.
- J. No wiring other than that directly associated with fire alarm detection, alarm or auxiliary fire protection functions shall be permitted in fire alarm conduits. Wiring splices are to be avoided to the extent possible, and if needed they must be made only in junction boxes and shall be crimp connected. Transposing or changing color coding or wires shall not be permitted. Wire nut-type connections are not acceptable. All conductors in conduit containing more than one wire shall be labeled on each end with "E-Z markers" or equivalent. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite to its terminal. Cabinet terminals shall be numbered and coded. All controls, function switches, etc., shall be clearly labeled on all equipment panels.
- K. Mount end-of-line device in control panel.
- L. All wiring shall be checked and tested to insure that there are no grounds, opens or shorts.
- M. Mount outlet box for electric door holder/release to withstand 80 pounds pulling force. Coordinate location with door contractor.
- N. Make conduit and wiring connections to door holder/release devices, sprinkler flow switches, sprinkler valve tamper switches, fire suppression system control panels, and duct smoke detectors.
- O. Automatic Detector Installation: Conform to NFPA 72.
- P. Adjust the audible alarms to 15dB above the ambient noise level, with a maximum setting of 120dB (per A.D.A. requirements).

3.02 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01400.
- B. Test in accordance with NFPA 72.

3.03 MANUFACTURER'S FIELD SERVICES

- A. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.

3.04 CERTIFICATION TESTING AND REPORTS

- A. The contractor shall perform all electrical and mechanical tests required by the equipment manufacturer's certification form. All test and report costs shall be in the contract price. A checkout report shall be prepared by the installation technicians and submitted in triplicate, one copy of which will be registered with the equipment manufacturer. The report shall include, but not be limited to:
 - 1. A complete list of equipment installed and wired.
 - 2. Indication that all equipment is properly installed and functions and conforms with these specifications.
 - 3. Test of individual zones as applicable.
 - 4. Serial numbers, locations by zone and model number for each installed detector.
 - 5. Voltage (sensitivity) settings for each ionization and photoelectric detector as measured in place with the HVAC system operating.
 - 6. Response time on thermostats and flame detectors (if used).
 - 7. Name, certificate number and date.
- B. After completion of all the tests and adjustments listed above, the contractor shall submit the following information to the Architect/Engineer:
 - 1. "As-Built" routing layout diagrams including wire color code and/or tag number.
 - 2. Complete "as-built" wiring diagrams.
 - 3. Detailed catalog data on all installed system components.
 - 4. Copy of the test report.
 - 5. Submit final documentation, as required, to the State Fire Marshal.
- C. Final tests and inspection shall be held in the presence of the Engineer. The contractor shall supply personnel and required auxiliary equipment for this test without additional cost.
- D. The completed smoke detection system shall be tested to insure that it is operating properly. Acceptance of the system shall also require demonstration of the stability of the system. This shall be adequately demonstrated if the system operates for a ninety (90) day test period.
- E. Before final acceptance of work, the contractor shall deliver five copies of a composite "Operating and Shop Maintenance Manual." Each manual shall contain, but not be limited to: a statement of guarantee including date of termination and name and phone number of the person to be called in the event of equipment failure.
- F. Individual factory issued manuals shall contain all technical information on each piece of equipment installed. In the event such manuals are not obtainable from the factory, it shall be the responsibility of the contractor to compile and include them. Advertising brochures or operational instructions shall not be used in lieu of the required technical manuals.
- G. Notify the Owner's Representative 3 working days in advance of tests. The tests shall be witnessed by the Owner.
- H. Provide a written NFPA 72-1996 Form 7.2 test report, signed and dated, prior to acceptance of the fire alarm system by the Owner.

3.05 DEMONSTRATION

- A. Demonstrate normal and abnormal modes of operation, and required responses to each.

3.06 SYSTEM TRAINING

- A. Arrange for the Manufacturer to train the Owner's Fire Alarm Technicians on the operation and maintenance of the system. This training shall be equal to the training given to the Manufacturer's Field Service Technicians. If the Owner's Technicians have already received the operations and maintenance training, the training requirement will be waived.
- B. Arrange for the Manufacturer to train the Owner's Fire Alarm Technicians on the system programming. This training shall be equal to the training given to the Manufacturer's Field Service Technicians. If the Owner's Technicians have already received the programming training, this requirement will be waived.

3.07 WARRANTY

- A. All equipment and systems shall be warranted by the contractor for a period of three years following acceptance. The warranty shall include parts, labor, prompt field service, pick-up and delivery.
- B. Provide one year testing and maintenance, which shall consist of:
 - 1. Regularly and systematically examining all detectors, manual stations, panels, relays, pressure switches, and accessories pertaining to the system.
 - 2. Regularly and systematically examine, adjust and clear all the electrical and mechanical components of water flow switches.
 - 3. Tests and written reports which certify that all initiating devices have been tested and which indicate the result of the inspection test as required by the authority having jurisdiction.
 - 4. The system supplier shall offer, complete with cost, a test and maintenance agreement providing the same service as described in this section to commence after expiration of test and maintenance included in this contract.
 - a. Include all labor and material required to maintain the system in the maintenance contract. Any perishable items supplied, such as batteries, shall be exempt from this requirement if indicated in the submitted documents.

END OF SECTION