

ALL TRADES SPECIFICATIONS

MELVINDALE-NORTHERN ALLEN PARK PUBLIC SCHOOLS
PROJECT NUMBER: 171739
DECEMBER 18, 2017

PROJECT

MELVINDALE-NORTHERN ALLEN PARK PUBLIC SCHOOLS STADIUM RENOVATION AT MELVINDALE HIGH SCHOOL

OWNER

Melvindale-Northern Allen Park Public Schools
18530 Prospect Avenue
Melvindale, Michigan 48122

ARCHITECT

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

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OWNER

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18530 PROSPECT AVENUE
MELVINDALE, MI 48122

ARCHITECT

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

CONSTRUCTION MANAGER

MCCARTHY & SMITH
24317 INDOPLEX CIRCLE
FARMINGTON HILLS, MI 48335
248-427-8400

MECHANICAL/ELECTRICAL

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

ATHLETIC CONSULTANT

FORESITE DESIGN
3269 COOLIDGE HWY.
BERKLEY, MI 48072
248-547-7757

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The following drawings, dated December 18, 2017, are issued for Melvindale-Northern Allen Park Public Schools, Stadium Renovation at Melvindale High School, Melvindale, MI 48122. Architect's Project Number 171739.

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END OF SECTION 00851

SECTION 01045 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1RELATED DOCUMENTS

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

1.2SUMMARY

- A. This Section specifies administrative and procedural requirements for cutting and patching.
- B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
 - 1. Requirements of this Section apply to mechanical and electrical installations. Refer to Division-15 and Division-16 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.
- C. Demolition of selected portions of the building for alterations is included in Section "Selective Demolition."

1.3SUBMITTALS

- A. Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:
 - 1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.
 - 2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
 - 3. List products to be used and firms or entities that will perform Work.
 - 4. Indicate dates when cutting and patching is to be performed.

5. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
6. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.
7. Approval by the Architect to proceed with cutting and patching does not waive the Architect's right to later require complete removal and replacement of a part of the Work found to be unsatisfactory.

1.4QUALITY ASSURANCE

- A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio.
- B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.
- C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1MATERIALS

- A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.
 - 1. Before proceeding, meet at the site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.
- C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 PERFORMANCE

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
 - 1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

- B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.
1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
 3. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.
 4. Comply with requirements of applicable Sections of Division-2 where cutting and patching requires excavating and backfilling.
 5. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.
- C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
 2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 3. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance.
 - a. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken containing the patch, after the patched area has received primer and second coat.

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4. Patch, repair or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.

3.4 CLEANING

- A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

END OF SECTION 01045

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
818 Connecticut Avenue, N.W.
Washington, DC 20006
- AABC Associated Air Balance Council
1000 Vermont Avenue, N.W.
Washington, DC 20005
- AASHTO American Association of State Highway
and Transportation Officials
444 North Capitol Street, N.W.
Washington, DC 20001

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ACI American Concrete Institute
 Box 19150
 Redford Station
 Detroit, MI 48219

ADC Air Diffusion Council
 230 North Michigan Avenue
 Chicago, IL 60601

AGC Associated General Contractors of America
 1957 E. Street, N.W.
 Washington, DC 20006

AI Asphalt Institute
 Asphalt Institute Building
 College Park, MD 20740

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

AISC American Institute of Steel Construction
 400 North Michigan Avenue
 Eighth Floor
 Chicago, IL 60611

AISI American Iron and Steel Institute
 1000 16th Street, N.W.
 Washington, DC 20036

AITC American Institute of Timber Construction
 333 W. Hampden Avenue
 Englewood, CO 80110

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

ANSI American National Standards Institute
 1430 Broadway
 New York, NY 10018

APA American Plywood Association
 Box 11700
 Tacoma, WA 98411

ARI Air Conditioning and Refrigeration Institute
 1501 Wilson Boulevard
 Arlington, VA 22209

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

ASME American Society of Mechanical Engineers
 345 East 47th Street
 New York, NY 10017

ASPA American Sod Producers Association
 4415 West Harrison Street
 Hillside, IL 60162

ASTM American Society for Testing and Materials
 1916 Race Street
 Philadelphia, PA 19103

AWI Architectural Woodwork Institute
 2310 South Walter Reed Drive
 Arlington, VA 22206

AWPA American Wood-Preservers' Association
 7735 Old Georgetown Road
 Bethesda, MD 20014

AWS American Welding Society
 550 LeJeune Road, N.W.
 Miami, FL 33135

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

BIA Brick Institute of America
 11490 Commerce Park Drive
 Reston, VA 22091

CDA Copper Development Association
 57th Floor, Chrysler Building
 405 Lexington Avenue
 New York, NY 10174

CLFMI Chain Link Fence Manufacturers Institute
 1101 Connecticut Avenue, N.W.
 Washington, DC 20036

CRSI Concrete Reinforcing Steel Institute
 933 Plum Grove Road
 Schaumburg, IL 60195

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DHI Door and Hardware Institute
7711 Old Springhouse Road
McLean, VA 22102

EJCDC Engineers' Joint Contract Documents Committee
American Consulting Engineers Council
1015 15th Street, N.W.
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
1151 Boston-Providence Turnpike
P.O. Box 688
Norwood, MA 02062

FS Federal Specification
General Services Administration
Specifications and Consumer Information
Distribution Section (WFSIS)
Washington Navy Yard, Bldg. 197
Washington, DC 20407

GA Gypsum Association
1603 Orrington Avenue
Evanston, IL 60201

ICBO International Conference of Building Officials
5360 S. Workman Mill Road
Whittier, CA 90601

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
1230 Keith Building
Cleveland, OH 44115

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MFMA	Maple Flooring Manufacturers Association 60 Rivere Drive Northbrook, IL 60062
MIL	Military Specification Naval Publications and Forms Center 5801 Tabor Avenue Philadelphia, PA 19120
ML/SFA	Metal Lath/Steel Framing Association 221 North LaSalle Street Chicago, IL 60601
NAAMM	National Association of Architectural Metal Manufacturers 221 North LaSalle Street Chicago, IL 60601
NCMA	National Concrete Masonry Association P.O. Box 781 Herndon, VA 22070
NEBB	National Environmental Balancing Bureau 8224 Old Courthouse Road Vienna, VA 22180
NEMA	National Electrical Manufacturers' Association 2101 'L' Street, N.W. Washington, DC 20037
NFPA	National Fire Protection Association Battery March Park Quincy, MA 02269
NFPA	National Forest Products Association 1619 Massachusetts Avenue, N.W. Washington, DC 20036
NSWMA	National Solid Wastes Management Association 1730 Rhode Island Ave., N.W. Washington, DC 20036
NTMA	National Terrazzo and Mosaic Association 3166 Des Plaines Avenue Des Plaines, IL 60018
NWMA	National Woodwork Manufacturers Association 205 W. Touhy Avenue Park Ridge, IL 60068

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PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 60077
PCI	Prestressed Concrete Institute 201 North Wells Street Chicago, IL 60606
PS	Product Standard U.S. Department of Commerce Washington, DC 20203
RIS	Redwood Inspection Service One Lombard Street San Francisco, CA 94111
RCSHSB	Red Cedar Shingle and Handsplit Shake Bureau 515 116th Avenue Bellevue, WA 98004
SDI	Steel Deck Institute P.O. Box 9506 Canton, OH 44711
SDI	Steel Door Institute 712 Lakewood Center North 14600 Detroit Avenue Cleveland, OH 44107
SIGMA	Sealed Insulating Glass Manufacturers Association 111 East Wacker Drive Chicago, IL 60601
SJI	Steel Joist Institute 1205 48th Avenue North Suite A Myrtle Beach, SC 29577
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association 8224 Old Court House Road Vienna, VA 22180
SSPC	Steel Structures Painting Council 4400 Fifth Avenue Pittsburgh, PA 15213
TCA	Tile Council of America, Inc. Box 326 Princeton, NJ 08540

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

WCLIB West Coast Lumber Inspection Bureau
6980 S.W. Varns Road
Box 23145
Portland, OR 97223

WWPA Western Wood Products Association
1500 Yeon Building
Portland, OR 97204

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION 01090

SECTION 01100 - ALTERNATES

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. This section identifies each Alternate by number, and describes the basic changes to be incorporated into the work, only when the Alternate is made a part of the work by specific provisions in the Owner-Contractor Agreement.
- B. Alternate schedule below is part of the Bidding Documents and will be considered in selection of Contractors and awarding contracts.
- C. Unless otherwise provided, Owner will accept or reject alternates within sixty (60) days of date of contract. Owner reserves the right to reject any or all alternates.

1.03 ALTERNATES:

A. General:

- 1. The descriptions for each alternate listed in the schedule are primarily scope definitions, and do not necessarily detail the full range of materials and processes needed to complete the work as required.
- 2. Refer to applicable specification sections (Division 2 through 16), and to applicable drawings, for specific requirements of the work, regardless of whether references are so noted in description of each alternative.
- 3. Coordinate pertinent related work and modify surrounding work as required to properly integrate the work under each Alternate, and to provide the complete construction required by Contract Documents.
- 4. Referenced sections of specifications stipulate pertinent requirements for products and methods to achieve the work stipulated under each Alternate.

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B. Schedule:

1. **Alternate No. 1:** Provide alternate bid for all costs associated with the construction of the Storage Building to be located east of the track adjacent to the field events.

END OF SECTION 01100

SECTION 01340 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 DESCRIPTION:

- A. Submit shop drawings, product data and samples as required by the Contract Documents. Individual submittal requirements are specified in applicable sections for each unit of work. Receive, check and coordinate all submittals of contractors as provided herein.

B. Definitions:

1. Shop Drawings are drawings, diagrams, schedules and other data specifically prepared for the Work by the Contractor or any subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.
2. Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate a material, product or system for some portion of the Work.
3. Samples are physical examples which illustrate materials, equipment or workmanship and establish standards by which the work will be judged.

1.03 SUBMITTAL REQUIREMENTS:

- A. Coordinate preparation and processing of submittals with performance of the work so that work will not be delayed by submittals. Coordinate and sequence different categories of submittals for the same work, and for interfacing units of work, so that one will not be delayed for coordination with another. No extension of time will be allowed because of failure to properly coordinate and sequence submittals.

- B. Submit one reproduction transparency and the two (2) prints of each shop drawing, including fabrication, erection, layout and setting drawings and such other drawings as required under various sections of the Specifications, until final acceptance is obtained. Prepare drawings legible, drawing plans, elevations, sections and details in scales required and on drawing sheets not larger than 30" x 42" nor smaller than 24" x 30". Submit copies of manufacturer's descriptive data including catalog sheets for materials, equipment and fixtures, showing dimensions, performance characteristics and capacities, wiring diagrams and controls, schedules, and other pertinent information as required. Where printed materials describe more than one product or model, clearly identify which is to be furnished.
- C. Shop drawings, product data and samples shall be dated including Contractor and Subcontractor dates of submittal and approval, and marked to show the names of the Project, Architect, Contractor, origination Subcontractor, manufacturer or supplier, and separate detailer if pertinent. Shop drawings shall completely identify Specification section and locations at which materials or equipment are to be installed. Reproductions of Contract Drawings are acceptable as Shop Drawings only when specifically authorized in writing by the Architect.
- D. Submission of shop drawings, product data and samples shall be accompanied by a copy of a transmittal letter containing Project name, Contractor's name, number of drawings, and samples, titles and other pertinent data. Transmittal shall bear signature of the Contractor as evidence he checked same and found them in conformance with the Contract Documents.
- E. The Contractor shall review, approve and submit, with reasonable promptness and in such sequence as to cause no delay in the Work or in the work of the Owner or any separate contractor, all Shop Drawings, Product Data and Samples required by the Contract Documents.
- F. By approving and submitting Shop Drawings, Product Data and Samples, the contractor represents that he has determined and verified all materials, field measurements, and field construction criteria related thereto, or will do so, and that he has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

- G. The Contractor shall not be relieved of responsibility for the deviation from the requirements of the Contract Documents by the Architect's acceptance of Shop Drawings, Product Data or Samples under Paragraph 13.12 of the General Conditions, unless the Contractor has specifically informed the Architect in writing of such deviation at the time of sub deviation. The Contractor shall not be relieved from responsibility for errors or omissions in the Shop Drawings, Product Data or Samples by the Architect's acceptance thereof.
- H. The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data or Samples, to revisions other than those requested by the Architect on previous submittals.
- I. No portion of the Work requiring submission of a Shop Drawing, Product Data or Sample shall be commenced until the submittal has been accepted by the Architect as provided in Paragraph 13.12 of the General Conditions. All such portions of the Work shall be in accordance with approved submittals.
- J. Architect will review Shop Drawings, Product Data and Samples as provided in Paragraph 13.12 of the General Conditions. He will mark each such submittal as follows:
1. Accepted - Where no comment made.
 2. Accepted as Noted - Where comments indicated on submittal qualifying, modifying, or otherwise changing it; however, submittal can be used for ordering, fabrication and erection at contractor's own risk until revised submittals have been made, reviewed and stamped acceptable.
 3. Not Accepted - Submittal not in conformance; revise and resubmit. Acceptance does not authorize any changes in the Contract Documents unless specifically stated in a separate letter or change order.
- K. Contractor is responsible for obtaining and distributing required prints of shop drawings to his subcontractors and material suppliers; after as well as before final approval. Prints of reviewed shop drawings shall be made from transparencies which carry the Architect's appropriate stamp.

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- L. Obtain copies of all shop drawings, product data and samples submitted to date and accepted from other contractors.

PARTS 2 and 3 - PRODUCT AND EXECUTION

Not applicable.

END OF SECTION 01340

SECTION 01400 - QUALITY CONTROL

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:

- A. Specific quality control requirements for the work are indicated throughout the contract documents. The term "Quality Control" includes, but is not necessarily limited to, inspection and testing and associated requirements. This section does not specify or modify Architect's duties relating to quality control and Contract enforcement.
- B. Coordinate quality control programs of separate contractors including submittals, conferences and on site programs.

1.03 RESPONSIBILITY:

- A. Residual Contractor Responsibility: Whatever required, inspection, testing and similar quality control provisions to be performed by independent agencies (not directly by the Contractor), and not indicated to be Owner's responsibility, shall be the Contractor's responsibility. The costs for those required services by independent testing laboratories are recognized to be included in Contract Sum.
- B. Contractor's General Responsibility: No failure of test agencies, whether engaged by Owner or Contractor, to perform adequate inspections or tests or to properly analyze or report results, shall relieve Contractor of responsibility for fulfillment of requirements of contract documents. It is recognized that required inspection and testing program is intended to assist the Contractor, Owner, Architect, and governing authorities in nominal determination of probable compliances with requirements for certain elements of work. The program is not intended to limit the Contractor's regular quality control program, as needed for general assurance of compliances.

1.04 QUALITY ASSURANCE:

- A. General Workmanship Standards: Comply with recognized workmanship quality standards within the industry as applicable to each unit of work, including ANSI standards where applicable. It is a requirement that each category of trades person or installer performing the work be prequalified, to the extent of being familiar with applicable and recognized quality standards for that category of work, and being capable of workmanship complying with those standards.
- B. Qualification of Quality Control Agencies: Except where another qualification standard is indicated, and except where it is specifically indicated that use of prime product manufacturer's test facilities is acceptable, engage independent testing laboratories complying with "Recommended Requirements for Independent Laboratory Qualifications" as published by American Council of Independent Laboratories, and specializing in type(s) of inspections and tests required.

1.05 SUBMITTALS:

- A. General: Refer to Section 01340, Shop Drawings, Product Data and Samples for requirements applicable to inspection and test reports, quality control samples, maintenance agreements, warranties, and similar documentation of quality compliances as required. Refer to individual work sections of Division 2 through 16 for specific certification and submittal requirements.
- B. Copies and Distribution: Where inspection and test reports and certifications are required by governing authorities, provide additional copies as required, and where required, send copies directly from inspection or testing agency to governing authority.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING:

- A. General: Handle, store and protect materials and products, including fabricated components, by methods and means which will prevent damage, deterioration and losses including theft (and resulting delays), thereby ensuring highest quality results as performance of the work progresses. Control delivery schedules so as to minimize unnecessary long-term storage at project site prior to installation.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION:

3.01 PREPARATION FOR INSTALLATION:

- A. Pre-Installation Conferences: Well in advance of installation of every major unit of work which requires coordination with other work, meet at the project site with installers and representatives of manufacturers and fabricators who are involved in or affected by the unit of work, and in its coordination or integration with other work which has proceeded or will follow. Advise Architect and Owner of scheduled meeting dates. At each meeting, review progress of other work and preparations for particular work under consideration, including requirements of contract documents, options, related change orders, purchases, deliveries, shop drawings, product data, quality control samples, possible conflicts, compatibility problems, time schedule, weather limitations, temporary facilities, space and access limitations, structural limitations, governing regulations, safety, inspection and testing requirements required performance results, recording requirements, and protection. Record significant discussions of each conference, and agreements and disagreements along with final plan of action. Distribute record of meeting promptly to everyone concerned, including Architect and Owner.
 - 1. Do not proceed with the work if associated pre-installation conference cannot be concluded successfully. Instigate actions to resolve impediments to performance of the work, and reconvene conference at earliest date feasible.
- B. Installer's Inspection of Conditions: Require Installer of each major unit of work to inspect substrate to receive the work, and conditions under which the work will be performed, and to report (in writing to Contractor) unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 COORDINATION OF TEST AGENCY WORK:

- A. Coordination with Owner's Agencies: Afford access and reasonable time in construction sequence for Owner's inspection and tests to be performed. Cooperate with agencies and provide incidental labor and services needed for the removal and delivery of test samples, and for inspections and taking measurements. Provide patching and restoration services where test samples have been removed, complying with individual technical sections of Divisions 2 through 16.
 - 1. Except for specialized laboratory sampling equipment, and except as otherwise indicated, supply and operate tools and construction equipment needed to obtain test samples from the work, including cutting devices for sawing, drilling, flame-cutting, coring and similar operations. Assist agencies in labeling and packing of test samples removed from the work.
- B. Coordination with Contractor's Independent Agencies: Except for required independent agency activities of inspection, measuring, testing, analyzing, reporting and similar activities, the assignment of labor, equipment, cutting, Patching and similar necessary activities associated therewith are Contractor's option recognizing that entire activity is Contractor's responsibility.
- C. Test Agency Responsibilities:
 - 1. Test agencies, regardless of whether engaged by Owner or Contractor, are not authorized to change or negate requirements of Contract Documents. Each agency shall coordinate its assigned work with construction schedule as maintained by Contractor, and shall perform its work promptly so as not to delay the work. Observances (by agencies) having a bearing on the work shall be reported to Architect in most expeditious way possible, and shall be recorded in writing by agency. Agency personnel shall not interfere with or assume duties of Contractor.
 - 2. Reports: The testing agency shall prepare reports of inspections and laboratory tests, including analysis and interpretation of test results where applicable. Properly identify each report and, where required, provide agency's certification of test results. Describe test methods used, and compliance with recognized test standards (if any). Complete and submit report at earliest possible date in each case.

3.03 INSTALLATION QUALITY CONTROL:

- A. Manufacturer's Instructions: Where installations include manufactured products, comply with manufacturer's applicable instructions and recommendations for installation, to whatever extent these are more explicit or more stringent than applicable requirements indicate in contract documents.
- B. Inspect each item of materials or equipment, immediately prior to installation, and reject damaged and defective items.
- C. Provide attachment and connection devices and methods for securing work properly as it is installed; true to line and level, and within recognized industry tolerances, if not otherwise indicated. Allow for expansions and building movements. Provide uniform joint widths in exposed work, organized for best possible visual effect. Refer questionable visual effect choices to Architect for final decision.
- D. Recheck measurements and dimensions of the work, as an integral step of starting each installation.
- E. Install work during conditions of temperature, humidity, exposed, forecasted weather, and status of project completion which will ensure best possible results for each unit of work, in coordination with entire work. Isolate each unit of work from non-compatible work, as required to prevent deterioration.
- F. Coordinate enclosure (closing-in) of work with required inspections and tests, so as to avoid necessity of uncovering work for that purpose.
- G. Mounting Heights: Except as otherwise indicated, mount individual units of work at industry-recognized standard mounting heights, for applications indicated. Refer questionable mounting height choices to Architect for final decision.
- H. Adjust, clean, lubricate, restore, marred finished, and protect newly installed work, to ensure that it will remain without damage or deterioration during the remainder of construction period.

END OF SECTION 01400

SECTION 02070 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1RELATED DOCUMENTS

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

1.2SUMMARY

- 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 built-in casework indicated "remove."
5. Removal of existing flooring and ceilings.
6. Removal and protection of existing fixtures, materials, and equipment items indicated "salvage."

- 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 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: Owner will occupy portions of the building immediately adjacent to areas of selective demolition. Conduct selective demolition work in manner that will minimize need for disruption of Owner's normal operations. Provide minimum of 72 hours advance notice to Owner of demolition activities that will affect Owner's normal operations.
- 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 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 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 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 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

3.1PREPARATION

- 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 dust-proof partitions of minimum 4-inch studs, 5/8-inch 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 if shutdown of service is necessary during changeover.

3.2DEMOLITION

- 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.
 4. Demolish foundation walls to a depth of not less than 12 inches below existing ground surface. Demolish and remove below-grade wood or metal construction. Break up below-grade concrete slabs.

5. For interior slabs on grade, use removal methods that will not crack or structurally disturb adjacent slabs or partitions. Use power saw where possible.
- 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.

3.3SALVAGED 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.

3.4DISPOSAL 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.

3.5CLEANUP 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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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

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SECTION 02110 - SITE CLEARING & REMOVALS

PART 1 - GENERAL

1.00 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.

1.01 SECTION INCLUDES

- A. Work included in this section includes the furnishing of all labor, materials, equipment and incidentals required for site clearing.
- B. Removal of surface debris, existing concrete, asphalt concrete and brick pavement as noted, curb and gutter, surface and underground utilities, fences, structures etc., designated plant life and grass.
- C. Removal of topsoil and subsoil, rough grading and site contouring as required to meet new grades indicated on the site plan.
- D. The extent of the site clearing is as shown on the drawings.

1.02 REGULATORY REQUIREMENTS

- A. Conform to applicable State and local codes for disposal of debris, burning debris on site will not be allowed.
- B. Coordinate clearing work with utility companies.
- C. Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. (Not Used).

PART 3 - EXECUTION

3.01 PROTECTION

- A. Identify and protect utilities to remain from damage.
- B. Protect trees, plant growth, and features designated to remain, as final landscaping. Identify and tag.

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- C. Verify that survey benchmark and intended elevations for the Work are as indicated.
- D. Traffic signs shall not be removed unless approved by the agency responsible for them.

3.02 CLEARING

- A. Clear areas as required for access to site and execution of the Work.
- B. Remove pavement, curbs and gutter, and old parking areas as indicated on site plans. Pavement and curb and gutter shall be removed to an existing joint or saw cut joint. An existing crack is not suitable for the limit of removal.
 - 1. Sawed joints shall extend through the full depth of pavement, providing a clean butt joint.
 - 2. If adjacent pavement or structures, that are to remain, are damaged as a result of the contractor's construction methods, pavement shall be recut or structures replaced at the contractors expense.
- C. Remove or relocate trees and shrubs indicated. All tree removal is to be verified and scheduled in advance with Architect and Owner before commencing removal work.
- D. Where the proposed work requires that a pole or guy be supported or relocated, the contractor shall make arrangements with the appropriate utility. Any cost for this shall be the contractor's expense.

3.03 ROUGH GRADING

- A. Identify required lines, levels, contours, and datum.
- B. Identify known underground, above ground, and aerial utilities. Stake and flag locations.
- C. Notify utility company or "Miss Dig" to stake utility locations.
- D. Excavate topsoil and subsoil from areas to be further excavated, re-landscaped, or re-graded.
- E. Stockpile topsoil and subsoil in area designated on site. Remove excess topsoil and subsoil not being reused, from site.

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3.04 CLEAN UP

- A. Remove debris, rock larger than 6 cu. ft. and extracted plant life from site.
- B. Burning is not permitted on the Owner's property. Remove waste materials and unsuitable and excess topsoil from the Owner's property and dispose of legally.

END OF SECTION 02110

SECTION 02210 - FINE GRADING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Work included: All labor, materials, necessary equipment and services to complete the Fine Grading work, as indicated on the drawings, as specified herein or both, except as for items specifically indicated as "NIC ITEMS".
- B. Related work specified elsewhere:

1.3 SITE INSPECTION

- A. The Contractor shall visit the site and acquaint himself with all existing conditions. The Contractor shall be responsible for his own subsurface investigations, as necessary, to satisfy requirements of this Section. All subsurface investigations shall be performed only under time schedules and arrangements approved in advance by the landscape Architect or Owner's Representative.

1.4 UTILITIES

- A. Before starting site operations verify that the earlier Contractors have disconnected all temporary utilities which might interfere with the fine grading work.
- B. Locate all existing, active utility lines traversing the site and determine the requirements for their protection. Preserve in operating condition all active utilities adjacent to or transversing the site that are designated to remain.
- C. Observe rules and regulations governing respective utilities in working under requirements of this section. Adequately protect utilities from damage, remove or relocate as indicated, specified or required. Remove, plug or cap inactive or abandoned utilities encountered in excavation. Record location of active utilities.

- D. Contact ``Miss Dig`` for existing utilities survey confirmation.

1.5 QUALITY ASSURANCE

- A. Requirements of all applicable building codes and other public agencies having jurisdiction upon the work.
- B. Primary emphasis should be given to the aesthetic appearance and functioning of berming and swales, as directed by the Landscape Architect or Owner's Representative. The Contractor shall employ skilled personnel and any necessary equipment to insure that finish grading is smooth, aesthetically pleasing, drains well and is ideal for receiving sod and plant materials.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Existing Soil:

- 1. Strip existing topsoil for new construction unless otherwise directed by Owner's Representative, free from debris, sod, biodegradable materials and other deleterious materials. The Contractor shall insure that all existing soil has sufficient percolation and surface drainage to support grasses and plant material and that extreme compaction occurs only in areas to receive paving.
- 2. In areas to receive seed, verify that soil is scarified to depth of 3" and that soil contains enough organic matter to support and encourage rooting of seeded lawn.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Job Conditions

- 1. Dust control: Use all means necessary to prevent dust from construction operations from being a nuisance to adjacent property owners and from damaging finish surfaces on adjacent building, paving, etc. Methods used for dust control are subject to approval by the Landscape Architect of Owner's Representative.
- 2. Burning: On-site burning will not be permitted.
- 3. Protection: Use all means necessary to protect curbs, gutters, sprinklers, utilities and vegetation

designated to remain, and, in the event of damage, immediately make all repairs, replacements and dressings to damaged plants necessary to the approval of the Landscape Architect. Contractor shall incur all cost for the replacement of damaged objects and vegetation.

3.2 SCHEDULING

- A. Schedule all work in a careful manner with all necessary consideration for adjoining property owners and the public.
- B. Coordinate schedule with other Contractors to avoid conflicts with their work.

3.3 EXCAVATION

- A. Excavate where necessary to obtain subgrades, percolation and surface drainage as required.
- B. Materials to be excavated are unclassified.
- C. Remove entirely any existing obstructions after approval by the Architect's or Owner's Representative.
- D. Remove from site and dispose of debris and excavated material not required.

3.4 GRADING

- A. The Contractor shall establish finished grades as shown on the construction plans and as directed by the Architect, including areas where the existing grade has been disturbed by other work.
- B. Finished grading shall be smooth, aesthetically pleasing, drain well and ready to receive sod and other plant material to full satisfaction of the Owner's Representative, Architect and Construction Manager.

3.5 COMPACTION

- A. Compact each layer of fill in designated areas with approved equipment to achieve a maximum density at optimum moisture, AASHTO T 180 - latest edition.
 - 1. Under buildings, roadways, curbs, walks and other paved areas: compaction shall be to 95% of maximum density.
 - 2. Under landscaped area, compaction shall not exceed 85% of maximum density.

- B. No backfill shall be placed against any masonry or other exposed building surface until permission has been given by the Owner's Representative, and in no case until the masonry has been in place seven days.
- C. Compaction in limited areas shall be obtained by the use of mechanical tampers or approved hand tampers. When hand tampers are used, the materials shall be deposited in layers not more than four inches thick. The hand tampers used shall be suitable for this purpose and shall have a face area of not more than 100 square inches. Special precautions shall be taken to prevent any wedging action against masonry or other exposed building surfaces.

3.6 CORRECTION OF GRADE

- A. Bring to required grade levels areas where settlement, erosion or other grade changes occur. Adjust grades as required to carry drainage away from buildings and to prevent ponding around the buildings and on pavements.
- B. Remove all rock or objectionable material larger than 1" any direction prior to commencing landscaping.
- C. Contractor shall be responsible for stabilizing grades by approved methods prior to landscaping, and shall be responsible for correction of grades as mentioned above, and clean up of any wash outs or erosion.

END OF SECTION 02210

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 and stockpiling.
5. Removing above-grade site improvements.
6. Disconnecting, capping or sealing, removing or abandoning site utilities in place.
7. Disposal of spoils, debris and waste materials.
8. Backfilling of depressions.

- B. Related Sections include the following:

1. Division 1 Section "Field Engineering" for verifying utility locations and for recording field measurements.
2. Division 1 Section "Construction Facilities and Temporary Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and environmental protection measures during site operations.
3. Division 2 Section "Selective Demolition" for partial demolition of buildings or structures undergoing alterations.
4. Division 2 Section "Tree Protection and Trimming" for protecting trees remaining on-site that are affected by site operations.

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5. Division 2 Section "Earthwork" for soil materials, excavating, backfilling, and site grading.
6. Division 2 Section "Landscaping" for finish grading, including placing and preparing topsoil for lawns and planting.

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 (50 mm) 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 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.
- B. Record drawings according to Division 1 Section "Contract Closeout."
 1. Identify and accurately locate capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

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1.7 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing indicated removal and alteration work on property adjoining Owner's property will be obtained by Owner before award of Contract.
- C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- D. Notify utility locator service for area where Project is located before site clearing.

PART 2 - PRODUCTS (Not Applicable)

2.1 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 2 Section "Earthwork."
 - 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

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. Contractor is responsible for obtaining soil erosion permit.
- C. Locate and clearly flag trees and vegetation to remain or to be relocated.
- 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. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
 - 1. Cover exposed roots with burlap and water regularly.
 - 2. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3. Coat cut faces of roots more than 1-1/2 inches (38 mm) in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
 4. Cover exposed roots with wet burlap to prevent roots from drying out. Backfill with soil as soon as possible.
- D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

3.3 UTILITIES

- A. Contractor will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing.
- B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
1. Owner will arrange to shut off indicated utilities when requested by Contractor.
 2. Arrange to shut off indicated utilities with utility companies.
- 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 Owner and Architect not less than three (3) days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Owner's or Architect's written permission.
- D. Excavate for and remove underground utilities indicated to be removed.
- E. Removal of underground utilities is included in Division 15 mechanical or Division 16 electrical Sections.

3.4 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 or to be relocated.
 - 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 (450 mm) below exposed sub grade.
 - 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 (200-mm) loose depth, and compact each layer to a density equal to adjacent original ground.

3.5 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 in area approved by Owner or Architect.

3.6 SITE IMPROVEMENTS

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- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

3.7 DISPOSAL

- A. Disposal of material: 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.
- B. Burning of materials on project property is prohibited.

END OF SECTION 02230

SECTION 02270 - SOIL EROSION CONTROL

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

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

1.2 SUMMARY

- A. The work under this Section includes all work necessary for effective soil erosion control in conformance with Part 91, Act 451, PA 1994, the Soil Erosion and Sedimentation Control Act, Michigan Department of Natural Resources Environmental Protection Act guidelines and all pertinent local enforcing agency rules and regulations.

- B. Related Sections include the following:

- 1. Section 02300 Earthwork

1.3 STANDARDS

- A. General: Perform all work under this Section in accordance with all pertinent rules and regulations, including, but not necessarily limited to those mentioned above and these Specifications.
- B. Conflicts: Where provisions of pertinent rules and regulations conflict with these Specifications, the more stringent provisions shall govern.

PART 2 - PRODUCTS

2.1 SEED, FERTILIZER, MULCH

- A. Refer to Section 02920.

PART 3 - EXECUTION

3.1 GENERAL

- A. Standards: Provide all materials and promptly take all actions necessary to achieve effective erosion control in accordance with the Soil Erosion and Sedimentation Control Act, Michigan Department of Natural Resources guidelines, local enforcing agency guidelines and these Specifications.

- B. Site evaluation: Prior to start of the Work, conduct a field evaluation of the site along with representatives of the Engineer/Architect and the local enforcing agency.
- C. Permits: Obtain all pertinent permits including a Soil Erosion Control Permit from the county or local enforcing agency. Submit the NPDES Notice of Coverage when the soil erosion permit is received.

3.2 SEEDING AND MULCHING

A. General

- 1. All bare soil, unless otherwise required by the Contract Documents, shall be seeded, fertilized and mulched to create a protected condition. Critical areas shall be sodded as approved by the Engineer/Architect and as shown on the Landscape Plans.
- 2. Seeding and mulching shall be performed immediately upon completion of a phase or section of the Work or as approved by the Engineer/Architect.
- 3. In all cases, seeding and mulching shall be performed within 30 days from the time the area was first disturbed.
- 4. During any period of time which the soil is unprotected, provide erosion control structures as necessary to minimize erosion and to keep any eroded soils on the site and out of ditches, rivers, storm sewers and wetlands.

- B. Seed: Seed shall be applied uniformly at a minimum rate of 48 pounds per acre.
- C. Fertilizer: Fertilizer shall be applied uniformly at a minimum rate of 250 pounds per acre.
- D. Mulch: Mulch shall be uniformly applied at a rate of 2 tons per acre, or equal.

3.3 DITCH AND RIVERS

- A. When reasonably possible, banks of ditches and rivers disturbed under this Work shall be protected within 24 hours of disturbance, but in no case shall banks be left unprotected more than 7 days.

3.4 STEEP SLOPES

A. Emulsion

1. On slopes greater than 20%, but not immediately adjacent to a stream or ditch, use erosion control blankets to hold seed in place.

- #### B. Other methods:
- Chemical self-adhering mulch and other mulch anchoring methods may be used as approved by the Engineer/Architect. Turf reinforcement matting may also be used.

3.5 SITE IMPROVEMENTS CONSTRUCTION

- #### A. During construction of the site improvements conform to the following general rules:

1. Minimize the amount of earth disturbed at any one time.
2. Establish a construction sequence which includes adequate erosion control.
3. Provide ground cover, even if only temporary, so as to stabilize an area and minimize erosion.
4. As much as practicable, direct storm water away from the construction area. Direct diverted storm water to any stable area.
5. Collect runoff from the site in sediment basins, traps or through filters.
6. Establish an inspection and maintenance schedule, paying special attention to the beginning of the various stages of construction. Employ a certified storm water operator and keep a log of the soil erosion and sedimentation control measures in accordance with the NPDES requirements.
7. Keep in mind that the primary objective is to keep the soil on the site.
8. Once final stabilization of the site is complete, and the governing agency has granted its approval, remove all temporary erosion control structures.

3.6 CLEANING

- #### A. Perform cleaning of all areas affected by work under this section and leave the site in a neat and tidy state. Contractor shall keep Adjacent Roads clean and free of debris.

END OF SECTION 02270

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. Drainage course for slabs-on-grade.
4. Subbase course for concrete walks and pavements.
5. Base course for asphalt paving.
6. Subsurface drainage backfill for walls and trenches.
7. Excavating and backfilling trenches within building lines.
8. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.

- B. Related Sections include the following:

1. Division 1 Section "Construction Facilities and Temporary Controls."
2. Division 2 Section "Site Clearing" for site stripping, grubbing, removing topsoil, and protecting trees to remain.
3. Division 2 Section "Dewatering" for lowering and disposing of ground water during construction.
4. Division 2 Section "Tree Protection and Trimming" for protecting and trimming trees to remain.
5. Division 2 Section "Excavation Support and Protection."
6. Division 2 Section "Foundation Drainage Systems" for drainage of footings, slabs-on-grade, and walls.
7. Division 2 Section "Landscaping" for finish grading, including placing and preparing topsoil for lawns and plantings.
8. Division 3 Section "Cast-in-Place Concrete" for granular course over vapor retarder.

9. 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.
- B. Base Course: Layer placed between the subbase course and asphalt 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. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations.
- G. Fill: Soil materials used to raise existing grades.
- H. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material 3/4 cu. yd. (0.57 cu. m) or more in volume.
- I. 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.
- J. Subbase Course: Layer placed between the subgrade and base course for asphalt paving, or layer placed between the subgrade and a concrete pavement or walk.
- 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. Product Data: For the following:
 - 1. Drainage fabric.
 - 2. Separation fabric.
- B. Test Reports: Testing laboratory shall submit the following reports directly to the architect and shall copy the contractor:
 - 1. Analysis of soil materials, whether procured on or off site, and including fill, backfill, and borrow materials.
 - 2. Verification of each footing subgrade.
 - 3. In-place density test reports.
 - 4. Moisture-density relationship test reports.
 - 5. Compressive strength or bearing test reports.
- C. 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.

1.5 QUALITY ASSURANCE

- A. Testing Laboratory Services
 - 1. The Construction Manager/Owner will secure and pay for the services of a qualified, independent geotechnical engineer to classify existing soil materials, to recommend and to classify proposed borrow materials when necessary, to verify compliance of materials with specified requirements, and to perform required field and laboratory testing. Geotechnical engineer shall be acceptable to the architect and the owner and shall be licensed to practice in the state in which the project is located.
- B. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.6 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect or Owner and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Architect and Owner not less than three (3) days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Architect's or Owner's written permission.
 3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials without additional cost to Owner when sufficient satisfactory soil materials are not available from excavations. Contractor is responsible for making an independent calculation to determine if satisfactory soils must be imported.
- B. Satisfactory Soil Material (ASTM D 2487): Free of stones larger than 2 inches in any dimension, trash, debris, organic material, other objectionable material and classified as follows:
1. GW (well-graded gravel).
 2. GP (poorly graded gravel).
 3. GM (silty gravel).
 4. GC (clayey gravel).
 5. SW (well-graded sand).
 6. SP (poorly graded sand).
 7. SM (silty sand).
- C. Unsatisfactory Soil Material (ASTM D 2487):
1. SC (clayey sand).

2. CL (lean clay).
3. ML (silt).
4. OL (organic clay).
5. OL (organic silt).
6. CH (fat clay).
7. MH (elastic silt).
8. OH (organic clay).
9. OH (organic silt).
10. PR (peat).

D. Backfill and Fill: Satisfactory soil materials.

E. Subbase: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (38-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

F. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch (38-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

G. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (38-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

H. 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 (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

I. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (38-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

J. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100

percent passing a 1-inch (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.

- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 ACCESSORIES

- A. Drainage Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; with minimum properties determined according to ASTM D 4759 and referenced standard test methods:
- B. Separation Fabric: Woven geotextile, specifically manufactured for use as a separation geotextile; made from polyolefins, polyesters, or polyamides; with minimum properties determined according to ASTM D 4759 and referenced standard test methods.

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 approved by agency having jurisdiction to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

- B. 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.

3.3 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

- A. General: Excavation includes the removal of any materials necessary to achieve the required subgrade elevations and includes reuse or disposal of such materials.
- B. Unnecessary Excavation: The expense of excavation of materials outside of limits indicated or ordered in writing by the architect and the correction thereof to the satisfaction of the Architect shall be borne by the contractor.
 - 1. Unnecessary excavation under footings: Either deepen footings to bear on actual subgrade elevation without changing top elevations or place concrete fill up to required elevation, as required by the architect.
 - 2. Unnecessary excavation other than under footings: Either place compacted fill or otherwise correct conditions, as required by the Architect.
- C. Approval of Subgrade: Notify the Architect when required elevations have been reached.
 - 1. When required by the Architect due to the unforeseen presence of unsatisfactory materials or other factors, perform additional excavation and replace with approved compacted fill material in accordance with the architect's instructions.
 - 2. Payment for unforeseen additional work will be made in accordance with established unit prices or, if none, in accordance with provisions for changes in the work. No payment will be made for correction of subgrades

improperly protected against damage from freeze-thaw or accumulation of water, or for correction of otherwise defective subgrades.

- D. Excavation Stabilization: Slope faces of excavations to maintain stability in compliance with requirements of governing authorities. Do not use shoring and bracing where faces can be sloped.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). 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. Pile Foundations: Stop excavations from 6 to 12 inches (150 to 300 mm) above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
 3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). 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.

- 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 (300 mm) higher than top of pipe or conduit, unless otherwise indicated.
- C. Trench Bottoms: Excavate and shape trench bottoms in accordance with the plans and standard details. Excavate trenches 4 inches (100 mm) deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe. Remove projecting stones and sharp objects along trench subgrade.
 - 1. Excavate trenches 6 inches (150 mm) deeper than elevation required and provide bedding course per the plan notes and/or details.

3.8 APPROVAL OF SUBGRADE

- A. If Architect determines 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.
- B. Proof roll subgrade with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.
- C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities.

3.9 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 at no additional cost to the Owner.

3.10 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.

3.11BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, dampproofing, waterproofing, and 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.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.12UTILITY 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. Place and compact initial backfill of subbase material, free of particles larger than 1 inch (25 mm), to a height of 12 inches (300 mm) over the utility pipe or conduit.
- C. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.

3.13FILL

- 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 satisfactory soil material.
 - 3. Under steps and ramps, use engineered fill.
 - 4. Under building slabs, use engineered fill.
 - 5. Under footings and foundations, use engineered fill.
 - 6. Over excavation area, use engineered fill or lean concrete.

3.14 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.

3.15 COMPACTION OF BACKFILLS AND FILLS

- A. Place backfill and fill materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) 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 698 and ASTM D 1557:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300

- mm) of existing subgrade and each layer of backfill or fill material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at 95 percent.
 3. Under lawn or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at 85 percent.

3.16 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. Provide a smooth transition between adjacent existing grades and new grades.
 2. 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 plus or minus 1 inch (25 mm).
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.17 SUBSURFACE DRAINAGE

- A. Drainage Piping: Drainage pipe is specified in Division 2 Section "Foundation Drainage Systems."
- B. Subsurface Drain: Place a layer of drainage fabric around perimeter of drainage trench. Place a 6-inch (150-mm) course of filter material on drainage fabric to support drainage pipe. Encase drainage pipe in a minimum of 12 inches (300 mm) of filter material and wrap in drainage fabric, overlapping sides and ends at least 6 inches (150 mm).

1. Compact each course of filter material to 95 percent of maximum dry unit weight according to ASTM D 698.
- C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches (300 mm) of final subgrade. Overlay drainage backfill with one layer of drainage fabric, overlapping sides and ends at least 6 inches (150 mm).
1. Compact each course of filter material to 95 percent of maximum dry density according to ASTM D 698.

3.18 SUBBASE AND BASE COURSES

- A. Install separation fabric on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
- B. Under pavements and walks, place subbase course on separation fabric according to fabric manufacturer's written instructions.
- C. Under pavements and walks, place subbase course on prepared subgrade and as follows:
 1. Place base course material over subbase.
 2. Compact subbase and 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.
 3. When thickness of compacted subbase or base course exceeds 6 inches (150 mm), place materials in equal layers, with no layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick when compacted.
- D. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches (300 mm) wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.19 DRAINAGE COURSE

- A. Under slabs-on-grade, install drainage fabric on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends. Place drainage course on drainage fabric and as follows:
- B. Under slabs-on-grade, place drainage course on prepared subgrade and as follows:
 - 1. Compact drainage 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 exceeds 6 inches (150 mm), place materials in equal layers, with no layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick when compacted.

3.20 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 any subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. 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.
- D. 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.

3.21 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

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eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

- C. Protect all existing trees, bushes, plants, etc. indicated to remain during construction activities.

3.22DISPOSAL 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. Contractor is responsible for making an independent calculation to determine if satisfactory soils must be exported.

END OF SECTION 02300

SECTION 02721 STORM SEWERS, UNDERDRAINS AND DRAINAGE STRUCTURES

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 work of this section. Where these specifications differ from the detail sheets included with the plans, the detail sheets shall govern.

1.2 SUMMARY

- A. The work under this Section includes, but is not necessarily limited to, the furnishing and installation of all storm sewers, underdrains and drainage structures and leads and connections as indicated on the Drawings, herein specified and as necessary for the proper and complete performance of this Work for foundations and underslab areas.
 - 1. Storm Sewer Pipe
 - 2. Culverts
 - 3. Perforated Underdrain Pipe
 - 4. Castings
 - 5. Manhole Sections and Steps
 - 6. Catch Basin
 - 7. Brick and Concrete Block Masonry
- B. Related Sections include, but not limited to, the following:
 - 1. Division 2 Section "Foundation Drainage Systems."
 - 2. Division 2 Section "Earthwork" for excavation and backfill.
 - 3. Division 3 Section "Cast-In-Place Concrete."
 - 4. Division 15 Mechanical Section "Storm Water System" for interior building systems including conductors, horizontal branches and connections to roof to deck drain.

1.3 QUALITY ASSURANCE

- A. Use only personnel completely trained and experienced in installation of the materials.

1.4 SUBMITTALS

- A. Shop Drawings: Shop drawing submittals are not required for storm sewer materials. Contractor is expected to conform to the plans, specifications, and details for this work. Submit material certificates in lieu of shop drawings. Material

certificates shall be signed by manufacturer and Contractor certifying that each material item complies with or exceeds requirements.

- B. Product Data: Include Manufacturer's literature and descriptive data.

1.5 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect the materials before, during and after installation.
- B. Replacements: In the event of damage, immediately make all necessary repairs and replacements acceptable to the Engineer and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, products that may be incorporated into the Work shall be as accepted by the Township.

2.2 STORM SEWER PIPE

- A. General: Storm sewer pipe shall be reinforced concrete pipe, corrugated polyethylene tubing, or smooth lined corrugated high density polyethylene pipe, as specified below and indicated on the plans, and shall be the sizes indicated on the drawings. Concrete pipe is an acceptable alternate for the HDPE pipe indicated on the plans.
- B. Reinforced Concrete Pipe
 - 1. Reinforced concrete pipe shall conform to ASTM C-76.72A, Type III & Type IV.
 - 2. Joints shall be premium rubber joint as acceptable to the Engineer unless otherwise specified on the drawings.
- C. Corrugated Polyethylene Tubing (CPT)
 - 1. Corrugated Polyethylene Tubing (CPT) shall conform to ASTM F405 and shall be perforated with sock where indicated on the plans.
 - 2. Joints shall be secured with a factory made snap-on or screen-on coupler for 4" and 6" diameter. Joints for 8" diameter and larger shall be a factory made coupler ties, bolts or screws on.

D. Smooth Lined Corrugated Polyethylene Pipe (SLCPP or HDPE)

1. Corrugated polyethylene pipe shall have a smooth interior wall, Manning's "n" of 0.012 or better and shall conform to AASHTO M294.
2. Joints shall be secured with a tied or bolted polyethylene coupler or shall be a factory made coupler which can be screw turned on to the end corrugations.
3. Corrugated polyethylene pipe shall be Advanced Drainage Systems N-12, Hancor HiQ or accepted equal.

E. Polyvinyl Chloride Pipe and Fittings (PVC)

1. PVC Sewer Pipe and Fittings, **NPS 15 (DN 375)** and Smaller: ASTM D 3034, SDR 26 for 8'' and smaller, SDR 35 for 10'' and larger, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

2.3 PERFORATED UNDERDRAIN PIPE (PE or CPP)

A. General

1. Perforated underdrain pipe shall be perforated, corrugated polyethylene pipe.
2. The pipe shall have a factory installed geotextile pipe wrap.
3. Perforation shall meet the requirements of AASHTO M 278.

B. Polyethylene Pipe (PE): Polyethylene pipe and fittings shall be standard strength and conform to ASTM F 405 and AASHTO M 252.

C. Polyvinyl Chloride Pipe (PVC): Polyvinyl Chloride pipe and fitting shall be standard strength and conform to ASTM F 800.

D. Geotextile Pipe Wrap: Geotextile pipe wrap shall weigh at least 3.5 ounces per square yard and shall conform to AASHTO M 288. It shall not be ripped or torn. The minimum tensile strength shall be 100 pounds.

2.4 CASTINGS

A. General: All castings shall be of cast iron, conforming to ASTM A 48 unless otherwise indicated. Conform to details and notes indicated on the plans.

2.5 MANHOLE SECTIONS

A. Manhole walls

1. Standard manhole walls shall be precast concrete units conforming to ASTM C 478, or be concrete block masonry.
2. Shallow manhole walls shall be precast concrete units or concrete block masonry as indicated on the Drawings.

B. Manhole bases: Manhole bases shall be either cast in place units or precast concrete units of the dimensions indicated on the Drawings.

2.6 MANHOLE STEPS

A. Manhole steps shall be of cast iron conforming to ASTM A 48 or equal, and shall meet pertinent safety rules and regulations.

2.7 CATCH BASINS

A. Construct catch basins of brick, block, masonry, or precast units. Precast concrete catch basin units, if used, shall have reinforcing steel conforming to ASTM C 76 II, Wall B.

2.8 INLETS

A. Construct inlets of smooth interior wall corrugated polyethylene pipe.

2.9 MORTAR

A. Mortar for brick masonry or plastering manholes shall be made of one part Portland cement to two parts sand, and materials and mixing shall correspond, in general, to Division 3 Section Concrete Work.

2.10 BRICK

A. Brick Work shall meet the requirements of Medium Brick of ASTM C 13.

2.11 CONCRETE BLOCK MASONRY

A. Concrete block masonry shall conform to ASTM C 139.

2.12 OTHER MATERIALS

- A. All other materials not specifically described but required for a complete and proper installation of the work of this Section, shall be new, first quality of their respective kinds, and as selected by the Contractor subject to review by the Engineer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection

- 1. Verify that all work under this Section may be installed in accordance with all pertinent codes and regulations, the original design and the reference standards.
- 2. All materials shall be inspected immediately before installation, and if found defective, immediately removed from the site.

B. Discrepancies

- 1. In the event of discrepancy, immediately notify the Engineer.
- 2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 EARTHWORK

- A. All earthwork required for the performance of the work of this Section shall be installed in accordance with Division 2 Section "Earthwork."

3.3 INSTALLATION

- A. General: Install all pipe and fittings in strict accordance with the manufacturer's recommendations as acceptable to the Engineer and other authorities having jurisdiction.

B. Handling

- 1. Distribute pipe and materials at the site as required, care to prevent damage to the pipe and materials.
- 2. Use proper tools and implements for safely handling and installing the pipe and other materials.
- 3. Protect the pipe and other materials from falling to the ground or into the trench.

4. Protect distributed pipe and materials from the public and passing vehicles.

C. Laying pipe

1. Lay all pipe true to line and grade with pipe ends abutting each other and the bell end facing the direction of laying.
2. Use laser alignment equipment to establish and maintain proper line and grade, unless otherwise directed.
3. Correct any deviation from line and grade at no additional cost to the Owner.
4. Protect workers at all times from cave-in and other hazardous conditions.

- D. Joints: Inspect each joint immediately after being completed and, if defective, shall be corrected before any more pipe is laid.

E. Concrete encasement

1. Place concrete encasements in locations and to the form and dimensions indicated.
2. Concrete for encasements shall be Class SE with that below the pipe dry mixed.
3. Take particular care to place the concrete under the pipe, and lay pipe in fresh concrete so that a complete support of the pipe will be made. Encasement at the sides and top may be placed after the concrete under this pipe has been set.

F. Manholes

1. Construct manholes as indicated on the Drawings and Specifications.
2. Take special care in forming the channels in the concrete bottom and use wooden templates or half sewer pipe for this work.
3. Plaster masonry work and castings as indicated on the Drawings.
4. In precast concrete manholes, the bottom section shall have cast openings of sufficient size to receive the sewer pipe. If such openings are not provided, the bottom portion may be constructed of masonry work from the concrete base to at least 6" above the top of the largest pipe entering the manhole and precast sections placed from the masonry to the desired top elevation.
5. All the annular space between the sewer pipe and the opening in the manhole section shall be filled with brick and/or masonry to provide a waterproof seal.

6. Place the manhole casting on a minimum of 3 courses of masonry brick and a maximum of 5 courses of manhole brick. Install bricks radially. Precast concrete adjusting rings may be used in place of brick.
7. Mortar joints have to be smooth tooled joints.

G. Catch basins and inlets

1. Construct catch basins and inlets as indicated on the Drawings and Specifications.
2. Place catch basin and inlet castings on a minimum of 3 courses of manhole brick and a maximum of 5 courses of manhole brick. Install brick radially. Precast concrete adjusting rings may be used in place of brick.

H. Trench bracing: Install trench bracing in accordance with safety and other pertinent rules and regulations, and Division 2 Section "Earthwork."

I. Erosion control and sedimentation: Contractor to provide erosion control to minimize introduction of sedimentation into the system.

3.4 CLEANING

- A. Prior to acceptance of storm sewers, underdrains, manholes and drainage structures, thoroughly clean those structures and remove all dirt and debris of whatever nature from inside sewer pipes, manholes and the like, and leave the site in a neat and clean condition.

END OF SECTION 02721

SECTION 02751 - CEMENT CONCRETE PAVEMENTS

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. Driveways and roadways.
- 2. Parking lots.
- 3. Curbs and gutters.
- 4. Sidewalks and platforms.
- 5. Wheel stops.

- B. Related Sections include the following:

- 1. Division 2 Section "Earthwork" for subgrade preparation, grading, and subbase course.
- 2. Division 2 Section "Pavement Joint Sealants" for joint sealants within concrete pavement and at isolation joints of concrete pavement with adjacent construction.
- 3. Division 2 Section "Pavement Markings."
- 4. Division 3 Section "Cast-in-Place Concrete" for general applications of concrete.

1.3 PERFORMANCE REQUIREMENTS

- A. Design paving for parking drives and commercial vehicles.

1.4 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.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer with at least three (3) years in business who has completed pavement work similar in material, design, and extent to that indicated for this Project.
- B. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer must be certified according to the National Ready Mix Concrete Association's Plant Certification Program.
- C. 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.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.
- E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixes.

1.6 PROJECT CONDITIONS

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- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
- B. Do not place concrete when base surface temperature is less than 40 degrees F (4 degrees C) or surface is wet or frozen.

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 curved conditions.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces.

2.2 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated flat sheets, unfinished.
- B. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed billet steel, unfinished.
- C. Epoxy-Coated Reinforcement Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars.
- D. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars; assembled with clips.
- E. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60 (Grade 420). Cut bars true to length with ends square and free of burrs.
- F. Epoxy-Coated Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60 (Grade 420), plain steel bars.

- G. Tie Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- H. Hook Bolts: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), internally and externally threaded. Design hook-bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
- I. 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.
- J. Epoxy Repair Coating: Liquid two-part epoxy repair coating, compatible with epoxy coating on reinforcement.

2.3 CONCRETE MATERIALS

- A. General: Use the same brand and type of cementitious material from the same manufacturer throughout the Project.
- B. Concrete Materials: As specified in Division 3 "Cast-in Place Concrete."

2.4 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry where indicated on Contract Documents.
- 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.

2.5 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips:
ASTM D 1751, asphalt-saturated cellulosic fiber.
 - 1. Thickness: $\frac{1}{2}$ inch minimum and thicker where indicated.
- B. Coloring Agent: Where indicated, ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.
 - 1. Color: Match Architect's sample.
- C. Pavement-Marking Paint: Alkyd-resin type; ready mixed; complying with FS TT-P-115, Type I, or AASHTO M 248, Type N.
 - 1. Color: Blue for handicapped requirements, yellow for fire lanes, white elsewhere.
- D. Wheel Stops: Precast, air-entrained concrete; 2500-psi (17.2-MPa) minimum compressive strength; approximately 6 inches (150 mm) high, 9 inches (225 mm) wide, and 84 inches (2130 mm) long. Provide chamfered corners and drainage slots on underside, and provide holes for dowel-anchoring to substrate.
 - 1. Dowels: Galvanized steel, diameter of $\frac{3}{4}$ inch (19 mm), minimum length 10 inches (254 mm).
- E. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- F. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- G. 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.

2.6 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.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the trial batch method.
- C. Proportion mixes to provide concrete with the following properties:
 - 1. Compressive Strength (28 Days): 3500 psi (24.1 MPa), unless otherwise indicated.
 - 2. Maximum Water-Cementitious Materials Ratio: 40% by weight.
 - 3. Slump Limit: 3 inches (75 mm).
 - 4. Maximum Aggregate Size: 1.5 inch (38 mm).
- D. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals.
- E. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 2.5 to 4.5 percent.
- F. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd. (0.60 kg/cu. m).
- G. Coloring Agent: Where indicated, add coloring agent to mix according to manufacturer's written instructions.

2.7 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 (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air

temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

- B. Project-Site Mixing: Comply with requirements and measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction and repair as required.
- B. Verify that grades are correct.

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.
- 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. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

- C. 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.
- D. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch (50-mm) overlap to adjacent mats.

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.
- 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 (38 mm) into concrete.
- 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 required.
 - 1. Extend joint fillers full width and depth of joint.
 - 2. Terminate joint filler less than 1/2 inch (12 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.
 - 3. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.

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- D. Expansion Joints: Place 1 inch (25 mm) wide expansion joints at 20 foot (6 m) intervals, if not indicated on drawings. Joints to be full depth of pavement.
- E. Install dowel bars and support assemblies at joints. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.
- F. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas. Construct $\frac{1}{4}$ inch wide contraction joints for a depth equal to at least one-third of the concrete thickness.
 - 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut ~~1/8-inch-~~ (3-mm-) wide joints $\frac{1}{4}$ inch deep into concrete slab.
- G. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to the following radius.
 - 1. Radius: ~~3/8 inch~~ (10 mm).

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 subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Do not add water to concrete during delivery, at Project site, or during placement.

- D. 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.
- E. Cold-Weather Placement: Comply with ACI 306.1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- F. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R when hot-weather conditions exist.

3.6 CONCRETE FINISHING

- A. General: Wetting of concrete surfaces during reseeding, initial floating, or finishing operations is prohibited.
- B. Float Finish: 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.
 - 1. Area Paving: Light broom, texture perpendicular to pavement direction.
 - 2. Curbs and Gutters: Light broom, texture parallel to pavement direction.
 - 3. Direction of Texturing: Parallel to pavement direction.
 - 4. Inclined Vehicular Ramps: Heavy broomed perpendicular to slope.
 - 5. Place sealer on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

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 (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions.
- C. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

- a. Water.
- b. Continuous water-fog spray.
- c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions.

3.8 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:

1. Elevation Variation: 1/4 inch (6 mm).
2. Thickness: Plus 3/8 inch (9 mm), minus 1/4 inch (6 mm).
3. Surface Variation: Gap below 10-foot- (3-m-) long, unlevelled straightedge not to exceed 1/4 inch (6 mm).

3.9 PAVEMENT MARKING

- A. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).

1. Paint stripes shall be at least 4 inches wide.

3.10 WHEEL STOPS

- A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded in holes cast into wheel stops. Firmly bond each dowel to wheel stop and to pavement. Extend upper portion of dowel 5 inches (125 mm) into wheel stop and lower portion a minimum of 5 inches (125 mm) into pavement.

3.11 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspection agency to sample materials, perform tests,

and submit test reports during concrete placement according to requirements specified.

B. Testing Services: Testing shall be performed according to the following requirements:

1. Compression Test Specimens: ASTM C 31/C 31M; 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.
2. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m). 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.

C. Test results shall be reported in writing to Architect, concrete manufacturer, and 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. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

3.12 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section.

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B. Protect concrete from damage. Exclude traffic from
pavement for at least 14 days after placement.

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MELVINDALE HIGH SCHOOL

171739

DECEMBER 18, 2017

SECTION 02835 - ORNAMENTAL METAL FENCING SYSTEM

AEGIS II - MAJESTIC 3-RAIL STYLE

PART 1 - GENERAL

1.01 WORK INCLUDED

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

1.02 RELATED WORK

- A. Section 02300 - Earthwork
- B. Section 03001 - Concrete

1.03 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.

1.04 QUALITY ASSURANCE

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

1.05 REFERENCES

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

1.06 SUBMITTAL

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

1.07 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 AEGIS II, 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 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 (specify

71-1/4" for 6' o.c. nominal or 96" for 8' 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 precut 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. See Drawings for sizes and dimensions.
- D. Ornamental Gates shall be fabricated using **AEGIS II** 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. See Drawings for sizes and dimensions.

PART 3 - EXECUTION

3.01 PREPARATION

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

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3.02 INSTALLATION

- A. Fence posts shall be set at spacings of 71-1/4" plus or minus 1/2", depending on the span specified. Gate posts shall be spaced according to the gate openings specified in the construction plans. The "Earthwork" and "Concrete" sections of this specification shall govern post base placement and material requirements. **AEGIS II** panels shall be attached to posts using panel brackets supplied by the bolt-on hardware supplied by manufacturer.

3.03 CLEANING

- A. The contractor shall clean the jobsite of excess materials; post hole excavations shall be scattered uniformly away from posts.

END OF SECTION 02835

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SECTION 02925 - CLEANUP AND RESTORATION

PART 1 - GENERAL

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

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 described in the specification for aggregate surfaces. 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 Driveways and Miscellaneous Pavement.

Turf areas shall be restored by re-establishing the turf as described in the specification for turf establishment. All areas disturbed by construction that are not to be surfaced with aggregate or pavement shall be restored with turf, unless otherwise directed.

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

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 1990 Michigan Department of Transportation Specifications.

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 02925

SALVAGE & RELOCATION OF FIELD ITEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.
- B. Related Sections:
 - 1. Section 31 1000 Site Preparation
 - 2. Section 31 2000 Earthwork
 - 3. Section 03 2400 Portland Cement Concrete
- C. Work Includes Relocation of the Following Items:
 - 1. Memorial Monument
 - 2. Flagpole

1.2 SCOPE

- A. The work under this section of the specifications shall consist of the relocation of all items as indicated on the drawings. Contractor shall furnish all labor, materials and equipment to complete the work according to the drawings and specifications.
- B. All other facilities and items that are indicated shall remain and be protected from construction damage.

PART 2 - PRODUCTS

N/A

PART 3 - EXECUTION

3.1 EXECUTION

- A. General
 - 1. Contractor shall relocate items shown on drawings. Locations shall be within District boundaries.
 - 2. Methods to be used in relocating items to be determined by the Contractor and approved by the Owner. Equipment damaged during relocation shall be replaced or repaired at the Contractor's expense.
 - 3. All work to be performed shall be under applicable Government Codes.
 - 4. All items requiring electrical or water will be attached to existing sources and left in working condition.
 - 5. All underground electric wiring shall be installed in PVC Conduit (with exception to 24 volt electrical irrigation wire).
 - 6. Demolish existing footings to a depth of 24" below proposed finish grade.
 - 7. Restoration of all existing equipment locations shall be performed by Contractor.

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B. Removal of Debris

1. Prompt removal of demolished items (i.e., concrete footings, slabs, etc.) from the site. Legally dispose of debris/material, including obtaining permission from applicable regulatory authority for disposal of debris/material to proper waste disposal site.

END OF SECTION 02 4110

DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.
- B. Related Sections:
 - 1. Section 31 1000 Site Preparation
- C. Work includes demolition of the following items:
 - 1. Trees
 - 2. Fencing, rails, and footings
 - 3. Bleachers and footings
 - 4. Topsoil
 - 5. Goalposts
 - 6. Track and Field Events
 - 7. Asphalt, Concrete and Base

1.2 SCOPE

- A. The work under this section of the specifications shall consist of the removal and disposal of all items as indicated on the drawings. Contractor shall furnish all labor, materials and equipment to complete the work according to the drawings and specifications.
- B. The work under this section of the specifications shall consist of the removal and disposal of all items as indicated on the drawings. Contractor shall furnish all labor, materials and equipment to complete the work according to the drawings and specifications.
- C. All other facilities and items that are indicated shall remain and be protected from construction damage. Areas damaged to known fault of the Contractor during construction shall be repaired or replaced at the expense of the Contractor. Lawn, paving, and concrete damaged during construction shall be restored to the condition which existed prior to commencement of Contractor's work.

PART 2 - PRODUCTS

N/A

PART 3 - EXECUTION

3.1 EXECUTION

- A. General
 - 1. Contractor shall not, for any reason, dump or leave any excavated materials on property.
 - 2. Contractor shall remove all items as indicated on drawings.

B. Removal of Debris

1. Promptly remove cleared debris from the site.
2. Burning of debris on site is not permitted, unless permission is obtained from applicable regulatory authority.
3. Obtain permission from applicable regulatory authority for disposal of debris to waste disposal site.
4. Upon the removal of fence posts and or footings, excavated areas shall be backfilled.
 - a. Backfill shall be excavated soil material, free of rock or gravel larger than 2" in any dimension, debris, waste, frozen materials, vegetable matter, and other deleterious matter. Existing materials may be used for backfill, provided no silt is mixed with material. Backfill consists of placement of acceptable soil material in compacted layers of 8" maximum depth, in excavations, using a "jumping jack or pogo stick" style compactor to required subgrade elevation, for each area.
 - b. Fill Material: Fill material shall be clean, hard, durable, uncoated particles of sand or sand gravel mixture, provided that there shall be a substantial excess of sand-screenings. Peastone is also acceptable backfill material.

END OF SECTION 02 4113

CAST IN PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.
- B. Related Sections:
 - 1. Section 31 1000 Site Preparation
 - 2. Section 31 2000 Earthwork

1.2 SCOPE

- A. The work under this section of the specifications shall consist of furnishing all labor, materials and equipment necessary to construct Portland cement concrete pad.

1.3 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. American Society for Testing and Materials (ASTM):
 - a. ASTM C 94-97 – Standard Specification for Ready Mixed Concrete
 - b. ASTM C 171-69 (1975) - Standard Specification for Sheet Materials for Curing Concrete
 - c. ASTM C 309-74 - Standard Specification for Liquid Membrane Forming Compound for Curing Concrete
 - d. ASTM D 1751-73 - Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

1.4 SUBMITTALS & TEST REPORTS

- A. Submit reports of Portland cement concrete compression, yield and air content tests listed in ASTM C 94.

1.5 ENVIRONMENTAL REQUIREMENTS PORTLAND CEMENT CONCRETE

- A. Allowable concrete temperatures
 - 1. Cold Weather: Maximum and minimum, ASTM C94
 - 2. Hot Weather: Maximum concrete temperature - 90 degrees F. (23 degrees C.)
- B. Do not place concrete during rain, sleet or snow.

1.6 PROTECTION

- A. Protect concrete from traffic for minimum of seven (7) days.

1.7 MEASUREMENT

- A. Sidewalk shall be considered part of lump sum price as per the proposal form including installation of aggregate base course and topsoil backfilling operation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Ready Mixed Concrete: ASTM C94

1. Cement type: type 3, grade A, 3500 psi (28 day compressive strength)
2. Admixtures: air-entrained 6%
3. Slump: two (2) to three (3) inches
4. Minimum 594 lbs. of cement per cubic yard.
5. No admixtures other than air-entraining without approval of the Landscape Architect.
6. Curing material: ASTM C171, 4 MIL white opaque polyethylene type, or ASTM C309, type 2, white pigmented curing compound.
7. Expansion Joint Fillers: ASTM D1751-73, performed non-extruding, resilient bituminous type, width as indicated on plans.
8. Wire fabric: 6 X 6 10/10 fabric in all slabs on grade unless otherwise indicated.
9. Reinforcing: Reinforcing shall be new, clean and free of rust deformed steel, size and location as noted on drawings.
10. Water: Clean, fresh, potable and free of deleterious amounts of acids, alkalis, organic materials and/or dissolved or suspended materials of any kind.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify the earthwork is completed to correct line and grade. Notify the Owner/Landscape Architect of any incomplete work by previous contractors.
- B. Check that sub-grade is smooth, compacted and free of frost or excessive moisture.
- C. Do not commence work until conditions are satisfactory.

3.2 WEATHER PROTECTION

- A. Cold weather: When the mean daily air temperature is 40 degrees F. or below, provide suitable protection for concrete work to maintain a minimum concrete temperature of 50 degrees F. for five (5) days (or 70 degrees F. for three (3) days). After the protection period, do not let concrete cool more than 20 degrees F. in each successive day
- B. Hot weather: Employ suitable means to prevent too rapid drying. Shade fresh concrete as soon as possible without marring surface.
- C. Wet weather: Unless adequate protection is provided, do not place concrete in rain, sleet or snow.

3.3 INSTALLATION

- A. Contractor shall install the first section of sidewalk as a quality sample in place. Upon approval of sample by Landscape Architect, further installation can proceed.
- B. The sub-grade upon which concrete is to be placed shall be prepared by excavation or filling with suitable earth to such depth below the finished grade line, that when tamped or rolled until smooth, firm and hard, the sub-grade will be uniform and at the required depth below finished grade line.

- C. Unsuitable sub-grade soils shall be replaced as directed.
- D. Gravel backfill, when specified in the drawings, shall be constructed to the required depth and thoroughly compacted.
- E. Cast in Place Concrete
 - 1. Set forms to line and grade
 - 2. Install forms over full length of walk and oil before use.
 - 3. Forms shall be set accurately to line and grade. If the forms are set more than 0.01 foot (3mm) above or below grade or more than 0.01 foot (6mm) from prescribed alignment, they shall be corrected before any concrete is placed
 - 4. Flexible or curved forms of proper radii shall be used on all curves having a radius of 100 feet or less.
 - 5. Form contraction joints by tooling.
 - 6. Install expansion joint material behind walks at abutment curbs and adjacent structures with expansion joints every 100 feet (30m) or as detailed. Retaining wall shall have expansion joints every 25 feet.
 - 7. Place top of expansion joint material flush with walk surface, unless noted otherwise on plans.
 - 8. Place concrete with mechanical vibrators.
 - 9. Consolidate concrete with mechanical vibrators.
 - 10. Round edges of walks at top with finishing tool, 1/4" to 3/8" radius. 1" radius for retaining wall.
 - 11. Finished exposed walk surfaces with wood float followed by brushing with broom, smooth band of 12", unless otherwise shown on drawings.
 - 12. Apply plastic sheeting or curing material and cure for seven (7) days.
 - 13. Apply plastic sheeting or curing material
 - 14. Do not allow free drop of more than five (5) feet. Use elephant trunk when necessary.
- F. Slip form concrete to the same quality standards as cast in place.
 - 1. Construct concrete walk with slip form curb machine.
 - 2. Apply curing material and cure for seven (7) days.
 - 3. Saw expansion and contraction joints after concrete has sufficiently hardened.

3.4 FIELD QUALITY CONTROL

- A. Slump Tests: Make slump tests whenever concrete is being poured at the direction of the Owner.
- B. Compression Tests: Prepare standard test cylinders during the placing of concrete in accordance with ASTM 31 and ASTM 172. One set (three (3) cylinders) is required for each day's pour.
- C. Maintain two (2) cylinders at 50 to 70 degrees F. and protect from loss of moisture at the job site for a period of not over 48 hours, then deliver to the laboratory for curing and testing at seven (7) and twenty-eight (28) days, respectively. Place third cylinder near the in place concrete and cure completely at the job in the same manner as the in place concrete. Deliver this cylinder to the laboratory for testing at twenty-eight (28) days. Cure and test cylinders in accordance with ASTM C31, C39 and C192. Submit test reports to the Landscape Architect in duplicate

3.5 PROTECTION OF FINISHED SURFACES

- A. All finished surfaces of concrete shall be protected so as to prevent damage. Marking temporary nailing or other damaging use of surfaces will be prohibited.

3.6 PATCHING

- A. Patch to match material, color and texture of surrounding area.
- B. Replace defective work if patching is not acceptable to the Landscape Architect.

3.7 REPAIR/REPLACE

- A. Within first year of placement, concrete will be replaced at no additional cost to the Owner, if horizontal and/or vertical cracks exceed 1/8".
- B. Hairline cracks do not qualify for concrete replacement.

3.8 CLEAN-UP

- A. The Contractor shall remove excess excavated material from the site of the work. Spread and finish grade within five (5) feet of pad edge. Finish grading is incidental to pad installation. Contractor shall clean up and dispose of rubble and construction satisfactory to the Owner and Landscape Architect.

END OF SECTION 03 3000

PORTLAND CEMENT CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.
- B. Related Sections:
 - 1. Section 32 1124 Aggregate Base Course

1.2 SCOPE

- A. The work under this section of the specifications shall consist of furnishing all labor, materials and equipment necessary to construct Portland cement concrete, turf anchor, concrete slabs, and foundations.

1.3 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. American Society for Testing and Materials (ASTM):
 - a. ASTM A185 – Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
 - b. ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - c. ASTM A82 – Standard Specification for Steel Wire, Plain for Concrete Reinforcement
 - d. ASTM C172 – Standard Practice for Sampling Freshly Mixed Concrete
 - e. ASTM C192 – Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
 - f. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete
 - g. ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
 - h. ASTM C31 – Standard Specification for Making and Curing Concrete Test Specimens in the Field
 - i. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
 - j. ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
 - k. ASTM C94 – Standard Specification for Ready-Mixed Concrete
 - l. ASTM C171-69 (1975) – Standard Specification for Sheet Materials for Curing Concrete
 - m. ASTM C309-74 – Standard Specification for Liquid Membrane Forming Compound for Curing Concrete
 - n. ASTM D1751-73 – Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

1.4 SUBMITTALS

- A. Test Reports: Reports of Portland cement concrete compression, yield and air content tests.

- B. Product Data: Submit data for propriety materials and items, including reinforcement and forming accessories, admixtures, patching compounds, joint systems, curing compounds, and others to the Landscape Architect/Engineer.
- C. Shop Drawings
 - 1. Reinforcement: Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement required and openings through concrete structures.
- D. Samples: Submit samples of materials as specified and as otherwise requested by Landscape Architect, including names, sources and descriptions.
- E. Material Certificates: Provide materials certificates in lieu of material laboratory test reports when permitted by Landscape Architect/Engineer. Material Certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Portland Cement Concrete
 - 1. Allowable concrete temperatures
 - a. Cold Weather: Maximum and minimum.
 - b. Hot Weather: Maximum concrete temperature: 90°F. (23°C.)
 - 2. Do not place concrete during rain, sleet or snow.

1.6 PROTECTION

- A. Protect concrete from traffic for minimum of seven (7) days.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

- A. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit. Minimum thickness for lumber form shall be 1" for boards and 5/8" for plywood.
- B. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.
- C. Forms for Slab-on-grade construction joints: Forms for slab-on-grade construction joints shall be prefabricated metal forms to produce tongue and groove joint. Form shall be approved by Architect/Engineer.
- D. Synthetic turf anchoring curb system: Forms shall be prefabricated metal forms to produce tongue and groove joint. Automated self propelled curb-and-gutter equipment shall not be allowed.

2.2 REINFORCING MATERIALS

- A. Reinforcing Bars: Grade 60, deformed
- B. Steel Wire: Plain, cold drawn, steel
- C. Welded Wire Fabric: Welded steel wire fabric, supplied in flat sheets.
- D. Supports for Reinforcement: Provide supports for reinforcement including 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, unless otherwise acceptable. Wood, brick and other devices shall not be acceptable.
 - 1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs. Concrete block or brick for support of reinforcement for slabs on grade shall be at least 2" wide, 3" long and of proper heights.

2.3 READY MIXED CONCRETE

- A. Cement type: type "1, 3500 psi" (28 day compressive strength)
- B. Admixtures:
 - 1. Air-entrained - 6%
 - 2. Fly Ash – Class C or F, except as modified herein.
 - a. Loss of ignition shall not exceed 4%.
 - b. Fine amount retained shall not exceed 25%.
 - c. Furnish documentation from an independent testing agency that fly-ash proposed for this project conforms to this specification."
- C. Slump: two (2) to three (3) inches.
- D. Minimum 564 lbs. of cement per cubic yard.
- E. No admixtures other than air-entraining without approval of the Architect.
- F. Water: Clean, fresh, potable and free of deleterious amounts of acids, alkalis, organic materials and/or dissolved or suspended materials of any kind.

2.4 CURING MATERIAL

- A. ASTM C171 4 MIL white opaque polyethylene type, or ASTM C309, type 2, white pigmented curing compound.

2.5 EXPANSION JOINT FILLERS

- A. Preformed non-extruding, resilient bituminous type, width as indicated on plans.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify the earthwork is completed to correct line and grade. Notify the Owner/Architect of any incomplete work by previous contractors.
- B. Check that sub-grade is smooth, compacted and free of frost or excessive moisture.
- C. Do not commence work until conditions are satisfactory.

3.2 WEATHER PROTECTION

- A. Cold weather: When the mean daily air temperature is 40°F. or below, provide suitable protection for concrete work to maintain a minimum concrete temperature of 50°F. for five (5) days (or 70°F. for three (3) days). After the protection period, do not let concrete cool more than 20°F. in each successive day.
- B. Hot weather: Employ suitable means to prevent too rapid drying. Shade fresh concrete as soon as possible without marring surface.
- C. Wet weather: Unless adequate protection is provided, do not place concrete in rain, sleet or snow.

3.3 INSTALLATION

- A. Contractor shall install the first section of sidewalk/slab/foundation as a quality sample in place. Upon approval of sample by Architect, further installation can proceed.
- B. The sub-grade upon which concrete is to be placed shall be prepared by excavation or filling with suitable earth to such depth below the finished grade line, that when tamped or rolled until smooth, firm and hard, the sub-grade will be uniform and at the required depth below finished grade line.
- C. Unsuitable sub-grade soils shall be replaced as directed.
- D. Gravel backfill, when specified in the drawings, shall be constructed to the required depth and thoroughly compacted.
- E. Cast in Place Concrete:
 - 1. Set forms to line and grade
 - 2. Install forms over full length of walk and oil before use.
 - 3. Forms shall be set accurately to line and grade. If the forms are set more than 0.01 foot (3mm) above or below grade or more than 0.01 foot (6mm) from prescribed alignment, they shall be corrected before any concrete is placed.
 - 4. Flexible or curved forms of proper radii shall be used on all curves having a radius of 100 feet or less.
 - 5. Form contraction joints by tooling.
 - 6. Install expansion joint material behind walks at abutment curbs and adjacent structures with expansion joints every 100 feet (30m) or as detailed. Retaining wall shall have expansion joints every 25 feet.
 - 7. Provide sawcuts in concrete turf anchor every 10 feet. Sawcut depth shall be no more 3/4" deep and 1/8" in width.
 - 8. Place top of expansion joint material flush with walk surface, unless noted otherwise on plans.

9. Place reinforcing materials.
10. Place concrete with mechanical vibrators.
11. Consolidate concrete with mechanical vibrators.
12. Round edges of walks and turf anchor at top with finishing tool, $\frac{1}{4}$ " to $\frac{3}{8}$ " radius. 1" radius for retaining wall.
13. Finished exposed walk surfaces with wood float followed by brushing with broom, smooth band of 12", unless otherwise shown on drawings.
14. Apply plastic sheeting or curing material and cure for seven (7) days.
15. Replace sections that pocket water.
16. Do not allow free drop of more than five (5) feet. Use elephant trunk when necessary.

3.4 FIELD QUALITY CONTROL

- A. Slump Tests: Make slump tests whenever concrete is being poured at the direction of the Owner.
- B. Compression Tests: Prepare standard test cylinders during the placing of concrete in accordance with ASTM C31 and ASTM C172. One set (three (3) cylinders) is required for each day's pour.
- C. Maintain two (2) cylinders at 50 to 70°F. and protect from loss of moisture at the job site for a period of not over 48 hours, then deliver to the laboratory for curing and testing at seven (7) and twenty-eight (28) days, respectively. Place third cylinder near the in place concrete and cure completely at the job in the same manner as the in place concrete. Deliver this cylinder to the laboratory for testing at twenty-eight (28) days. Cure and test cylinders in accordance with ASTM C31, C39 and C192. Submit test reports to the Architect in duplicate.

3.5 PROTECTION OF FINISHED SURFACES

- A. All finished surfaces of concrete shall be protected so as to prevent damage. Marking temporary nailing or other damaging use of surfaces will be prohibited.

3.6 PATCHING

- A. Patch to match material, color and texture of surrounding area.
- B. Replace defective work if patching is not acceptable to the Landscape Architect.

3.7 REPAIR/REPLACE

- A. Within first year of placement, concrete will be replaced at no additional cost to the Owner, if horizontal and/or vertical cracks exceed $\frac{1}{8}$ ".
- B. Hairline cracks do not qualify for concrete replacement.

3.8 CLEAN UP

- A. The Contractor shall remove excess excavated material from the site of the work. Spread and finish grade topsoil within five (5) feet of pad edge. Topsoiling is incidental to concrete installation. Contractor shall clean up and dispose of rubble and construction debris satisfactory of the Owner and the Landscape Architect.

END OF SECTION 03 3010

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MORTAR

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.
- B. Related Sections:
 - 1. Section 33 4413 Manholes, Catch Basins and Similar Structures

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. General Requirements:
 - 1. Specific materials (brands, trade names, sources of supply, etc.) must be approved by Landscape Architect before any materials are ordered.
 - 2. Once approved, the same materials must be used throughout entire job.
- B. Portland Cement: ASTM C150, Type 1.
- C. Sand: ASTM C144. Must be washed.
- D. Lime: Hydrated lime for masonry purposes, ASTM C207, Type S.
- E. Pea Gravel: ASTM C33, size #8 (1/4" – 3/8")
- F. Water: Clean, fresh, potable and free of deleterious amounts of acids, alkalis, organic materials and/or dissolved or suspended materials of any kind.
- G. Mortar Coloring for Block: Mortar for block shall be natural mortar color.
- H. Other Admixtures: None, unless authorized by Landscape Architect prior to application.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Mortar shall be Portland cement-lime mortar mix proportioned with 1 part cement, 1 part lime, 6 cu.ft. sand (Type S Mix). Prepared mortar shall not be used.
- B. Mortar shall comply with requirements of ASTM C270 for Type S (1500 PSI compressive strength) mortar.
- C. Mortar shall contain minimum of 12% and maximum of 12% entrained air.
- D. Use all mortar within 2-1/2 hours after mixing.

- E. Mortar may be retempered as required, but in no case, if retempering is due to loss of water by hydration.

3.2 BOND PATTERN

- A. Lay concrete block in bond pattern with uniform coursing and jointing. Maintain vertical joints in line, with bond pattern carefully preserved. Joints shall be $3/8"$ ($\pm 1/8"$).
- B. Commence tooling joint when mortar is "thumb hard" and bonds to the course above without leaving hair cracks. Unless otherwise required, cut flush and concealed joints; tool interior and exterior exposed joints in block to a uniform compressed concave surface with an oversize jointing tool.
- C. Rake out mortar in preparation for application of caulking or sealants where shown.
- D. Joints that are not tight at time of tooling shall be raked out.
- E. Units disturbed after laying: Remove, clean, and relay in fresh mortar.

END OF SECTION 04 0513

FOOTBALL GOAL POSTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.
- B. Related Sections:
 - 1. Section 03 3010 Portland Cement Concrete
 - 2. Section 31 2000 Earthwork

1.2 SCOPE

- A. The work under this section of the specifications shall consist of furnishing all labor, materials and equipment necessary to install new football goal posts.

1.3 QUALITY ASSURANCE

- A. Warranty Guarantee: The Contractor and any Sub-Contractors hereunder guarantee their respective work against defective materials or workmanship for a period of two (2) years from the date of filing notice of completion and an acceptance by the Owner.
- B. Product Testing: All material installed under this specification shall be subject to testing by Owner at his expense. Any material so inspected and found to be not in strict conformance with this specification shall be promptly removed and replaced by the Contractor at his expense.
- C. General: Comply with NCAA and NFHS specifications.

1.4 SUBMITTALS

- A. Submit manufacturer literature, identifying the particular item to be installed. Manufacturer information should include photographs, catalog cut sheets and applicable technical information.

PART 2 - PRODUCTS

2.1 FOOTBALL GOAL POSTS

- A. Football goal posts shall:
 - 1. Be formed with an aluminum pipe capable of supporting the horizontal cross bar 8'-0" in front of the vertical upright.
 - 2. Upright shall extend or be supported in a concrete footing approximately 5' in diameter and secured with an anchor pin or anchor bolts.
 - 3. Cross bar shall be an aluminum structural tube 10'-0" above field level.
 - 4. Uprights shall be 4" O.D. aluminum structural tube extending 20'-0" above horizontal cross bar. Uprights and cross bar shall be capped with zinc plated formed metal caps. Upright metal caps shall incorporate nylon wind directional flags.
 - 5. Wind directional flag shall be red.
 - 6. Goal post shall be powder-coated white.

- B. Goal posts shall be from one of the following manufacturers:
1. AAE - No. ASG-HS/8, (810) 694-2976
 2. Sportsfield Specialties - No. GP4380PL, (888) 975-3343
 3. UCS - No. 751-6120, (800) 526-4856
 4. SportsEdge – No. SEF305P, (800) 334-6057
- C. Goal post pads shall be “professional” style made from 6” thick cylindrical shaped high density polyurethane foam, 8’-0” in length. Foam cylinder shall have a rear cut-out and be completely covered in a 16 oz. polyester reinforced vinyl cover concealed velcro closure flaps for ease of installation and removal. Color to be selected by Owner. Letters will be stenciled onto the vinyl cover at no additional cost to the Owner. The Contractor shall supply a color sample or swatch to the Owner for color selection for the pads and a maximum of ten (10) letters per pad.
- D. Goal post pads shall be from one of the following manufacturers:
1. AAE - No. GP6R
 2. Sportsfield Specialties - No. GP4590RFULL
 3. UCS - No. 260-68
 4. SportsEdge – No. SEF302
- E. Pre-manufactured access box shall be from one of the following manufacturers:
1. Sportsfield Specialties – No. GP4570
 2. SportsEdge – No. SEF304
 3. AAE – No. FBC-GA

2.2 CONCRETE

- A. Concrete shall conform to Section 03 30 10 Portland Cement Concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not install goal posts until site grading is complete.

3.2 INSTALLATION

- A. Posts shall be set to the lines shown on the drawings, with holes drilled such that posts will be centered in the concrete bases.
- B. Holes shall be filled with concrete to 6” below grade. See detail sheet as per installation of the remaining 6” to grade.
- C. Concrete shall cure a minimum of 72 hours prior to installation of goal post.
- D. All posts shall be set plumb.
- E. Refer to Manufacturer’s installation cut sheets for exact location of sleeve or bolt template.

3.3 CLEAN UP AND DISPOSAL

- A. Remove from the site all equipment, materials, and debris resulting from construction work including this section. Leave work area neat and clean and in a condition acceptable by the Landscape Architect and Owner. All work shall be complete, ready for use, at the time of final acceptance.

END OF SECTION 11 6834

MELVINDALE-NORTHERN ALLEN PARK PUBLIC SCHOOLS

ATHLETIC FACILITY IMPROVEMENTS

BID PACKAGE #1

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PORTABLE SOCCER GOALS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.

1.2 SCOPE

- A. The work under this section of the specifications shall consist of furnishing all labor, materials and equipment necessary to furnish and install complete portable soccer goals. Includes, but not limited to goal nets, wheel kits, and sand bag anchors.

1.3 QUALITY ASSURANCE

- A. Warranty Guarantee: The Contractor and any Sub-contractors hereunder guarantee their respective work against defective materials or workmanship for a period of two (2) years from the date of filing notice of completion and an acceptance by the Owner.
- B. Product Testing: All material installed under this specification shall be subject to testing by Owner at his expense. Any material so inspected and found to be not in strict conformance with this specification shall be promptly removed and replaced by the Contractor at his expense.
- C. General: Comply with NCAA and NFHS specifications.

1.4 SUBMITTALS

- A. Submit manufacturer literature, identifying the particular items to be installed. Manufacturer information should include photographs, and applicable technical information, and other data required to demonstrate compliance with specified requirements for all athletic equipment.

PART 2 - PRODUCTS

2.1 SOCCER GOALS

- A. Full size round soccer goals complete with nets, wheel kits and sandbags, shall be from one of the following manufacturers:
 - 1. Aluminum Athletic Equipment Co. (AAE) 810-694-2976
 - 2. Keeper Goals 800-594-5126
 - 3. KwikGoal 800-531-4252
 - 4. Scoremaster 888-726-7627
 - 5. United Canvas Swing (UCS) 800-526-4856
- B. Components:
 - 1. Frame: 8'H x 24'W x 4'B x 10'D.
 - a. 4" Round aluminum tubing.
 - b. White powder coat finish.
 - 2. Backstays: 2" O.D. aluminum backstays
 - 3. Ground Bar: Aluminum
 - 4. For Infill Turf Fields: Include safety anchor system to attach to football goal gooseneck.

MELVINDALE-NORTHERN ALLEN PARK PUBLIC SCHOOLS

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5. Nets: 4mm braided polypropylene, 5.5" square mesh.

C. Full size round soccer goals complete with nets, wheel kits and sandbags, shall be from one of the following manufacturers:

Manufacturer	Product	Model No.	Type
1. AAE	Goal	SGR-P	Round
	Net	SN-4	
	Wheels	RW-SG	
2. KwikGoal	Goal	2B3006	Round
	Net	Included	
	Wheels	10B407	
1. Scoremaster	Goal	SM-DM2400	Round
	Net	SM-REG-NET-DM24	
	Wheels	SM-DM-WHEEL	
2. Keeper Goals	Goal	M83-RD4	Round
		(wheel kit included)	
		M88-W-RD4	Round
		(w/ attached wheels)	
	Net	NP2-824	
5. UCS	Goal	900-8024	Round
		(wheel kit included)	
	Net	900-8026	

***All soccer goals units must be supplied with sandbags for anchoring and wheel kits.**

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not install goals until site grading is complete.

3.2 INSTALLATION

A. Assembled as per manufacturer's cut sheets.

3.3 CLEAN UP AND DISPOSAL

A. Remove from the site all equipment, materials, and debris resulting from construction work including this section. Leave work area neat and clean and in a condition acceptable by the Landscape Architect and Owner. All work shall be complete, ready for use, at the time of final acceptance.

END OF SECTION 11 6836

FIELD EVENT CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.
- B. Related Sections:
 - 1. Section 03 3000 Cast In Place Concrete

1.2 SCOPE

- A. The work under this section of the specifications shall consist of furnishing all labor, materials and equipment for the installation of the field event equipment according to the drawings and specifications. (See Plans & Details for quantity).

1.3 QUALITY ASSURANCE

- A. Warranty Guarantee: The Contractor and any Sub-Contractors hereunder guarantee their respective work against workmanship for a period of two (2) years. Standard manufacturer's warranty shall apply to products being provided. Warranty period begins on the date of filing notice of completion and an acceptance by the Owner.

1.4 SUBMITTALS

- A. Submit manufacturer literature, identifying the particular item to be installed. Manufacturer information should include photographs, and applicable technical information.

PART 2 - PRODUCT

2.1 MANUFACTURERS:

- A. SportsEdge. (800) 334-6057
- B. Gill Athletics, Inc (800) 637-3090
- C. Aluminum Athletic Equipment Co. (AAE) (810) 694-2976
- D. United Canvas Swing (UCS) (800) 526-4856
- E. Sportsfield Specialties, Inc. (888) 975-3343

2.2 LONG JUMP

- A. Take-off board(s)
 - SportsEdge SE446
 - AAE #HTB-16 System
 - Sportsfield Specialties, #TFLT0016SS

2.3 POLE VAULT

- | | |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| A. Vault Box(es) w/cover | AAE #SSVB with cover
UCS #711-1200 with cover
Gill # 504 with cover
Sportsfield Specialties TFPV 002SS w/Cover
SportsEdge SE504 w/ Cover |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|

2.4 DISCUS

- | | |
|----------------------------------------------|----------------------------------------------------------------------------------------|
| A. Discus throwing circle
(Flush mounted) | AAE #DC
UCS #725-2565
Gill # 371
Sportsfield Specialties SSI371 |
| B. Discus cage | AAE #HSDC & BNHSDC
Gill #8030
UCS #570-0100
Sportsfield Specialties TFDCHS014 |

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all equipment as per manufacturer's recommendations.
- B. Contractor shall verify with Owner and Landscape Architect the pole vault cushion(s) to be purchased prior to installation of vault box and surrounding pad (See Plans & Details).

3.2 CLEAN UP AND DISPOSAL

- A. Remove from the site all equipment, materials, and debris resulting from construction work including this section. Leave work area neat and clean and in a condition acceptable by the Landscape Architect and School District. All work shall be complete, ready for use, at the time of final acceptance.

END OF SECTION 11 6840

PRESSBOX

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.
- B. Related Sections:
 - 1. Section 03 3010 Portland Cement Concrete
 - 2. Section 13 3520 Grandstands Leg Truss

1.2 SCOPE

- A. The work under this section of the specifications shall consist of furnishing all labor, materials and equipment necessary to furnish and install a prefabricated, modular (2) 8' x 12' Pressboxes. Entrance to Pressbox shall be elevated above top row as shown and have landings at one end of Pressbox from bleachers, constructed of standard components and front lower closure to top row of seating. Grandstand Contractor shall provide and install the Pressbox.

1.3 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. American Society for Testing and Materials (ASTM):
 - a. C 94-97, Ready Mixed Concrete
- B. Manufacturer Qualifications: The pressbox shall be designed by a recognized manufacturer, who has at least 5 years of experience and who is, or who employs a licensed Professional Engineer (State of Michigan) who is available, at reasonable times during the course of the work, for consultation about project's requirements, to Owner, Landscape Architect, or Contractor.
- C. Installer Qualifications: Factory trained and experienced in the proper installation of pressboxes. Must be an approved manufacturer listed with the State of Michigan for Premanufactured Units.
- D. Warranty Guarantee: All material furnished under this Contract shall be guaranteed free from defects in manufacturing and capable of performing the duties required for which it is designed for a period of one (1) year after final acceptance. Any material failing to comply with the above guarantee shall be replaced with satisfactory material at the Contractor's expense. All door closers shall be guaranteed for five (5) years.
- E. Fire-Rated Openings: Provide for fire-rated opening in compliance with NFPA standard No. 80 and local building code requirements. Provide only hardware which has been tested and listed by UL or FM for types and sizes of doors required and complies with requirements of door and door frame labels.
- F. Pressbox shall comply with all local and federal codes, whichever is more stringent. Landscape Architect will submit pressbox design to State Fire Marshall for final approval.

1.4 SUBMITTALS

- A. Manufacturer's Literature: Furnish to Landscape Architect, when required, copies of manufacturer's specifications, maintenance and installation instructions. Include photographs, catalog cuts, and other data as may be required to show compliance with these specifications.
- B. Finish and color: Submit to the Landscape Architect, when requested, item finish samples. Landscape Architect's review and selection shall be for color and texture only of finish surface. Compliance with all other requirements is the exclusive responsibility of the Contractor.
- C. Samples: If requested by Landscape Architect, a sample of each interior item, properly marked and tagged for identification shall be submitted for review. After final review, deliver samples to job site for comparison with products delivered for installation. Unblemished samples may be used in the work.
- D. Finish Hardware Schedule: Submit to the Landscape Architect for review, copies of finish hardware schedule covering complete identification of all items required for the project. Include manufacturer's names and identification of finishes. Include a separate schedule of key and master-key system with final submittal of schedule. Landscape Architect's review and approval of schedules shall neither be construed as a complete check nor shall it relieve the supplier of responsibility for errors, deviations or omissions from requirement to provide complete hardware for project.
- E. Schedules of hardware shall include a preface sheet showing category only on manufacturer's names of all items to be furnished in the following format:

<u>Category</u>	<u>Specified</u>	<u>Scheduled</u>
Hinges	Manufacturer A	Manufacturer B
Locksets	Manufacturer F	Manufacturer F
Kick Plates	Manufacturer X	Manufacturer X

- 1. Door description shall include single or pair, number, location, hand, active leaf, degree of swing, size, material, frame material and UL listing mark.
 - 2. Hardware description shall include quantity, category, catalog number, fasteners and finish.
 - 3. Supplier's scheduling sequence shall be in duplication of that shown in Hardware Groups. Furnish "vertical" scheduling format only.
 - 4. Each heading number in supplier's schedule shall include a reference to Landscape Architect's Hardware Group Number.
 - 5. The scheduling format and sequence of schedule shall comply with recommendations of the American Society of Landscape Architectural Hardware Consultants.
 - 6. Submittal Sequence: Submit schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work. (ie. Hollow metal frames) which is critical in the project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by finish hardware, and other information essential to the coordinated review of hardware schedule.
- F. Catalog Cuts
- 1. Provide in booklet form using Supplier's schedule covers as binders four copies of catalog pages of all pieces of hardware listed in Supplier's Schedule that are other than those shown in the Specification.
 - 2. Submit Catalog Booklets concurrently with copies of Hardware Schedule.
 - 3. Review of Hardware Schedule will not begin until Catalog Booklets have been received. At least one copy of Catalog Booklet will be stamped and returned.

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

1.5 PRODUCT HANDLING

- A. Package each item of Finish Hardware complete with all screws, bolts, expansion shields, anchors and other fasteners, installation instructions, templates and special adjusting keys or wrenches required for installation. Mark door location and Finish Hardware Schedule Item number on each Package.
- B. Delivery of Materials
1. Deliver materials to the job site unless otherwise directed. All products shall be delivered in their original containers and each item clearly marked. A packing list shall accompany each shipment using item numbers that conform with approved schedule.
 2. The Contractors receiving hardware from this supplier shall sign receipts for same and any subsequent loss and/or missing articles of hardware shall then become the responsibility of the receiving Contractor.
 3. Inventory all materials jointly with representative of supplier and installer until each is satisfied that the count is correct.
 4. Deliver individually packaged hardware items to the proper locations for installation.
 5. Provide secure lock-up for materials delivered to the project, but not yet installed. Control handling and installation of materials which are not immediately replaceable, so that completion of work will not be delayed by losses, both before and after installation.
 6. Provide a typewritten schedule with each shipment in conformity with the approved and filed schedule. The parties receiving materials from this contractor will receipt in duplicate.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A.
- | | <u>Company</u> | <u>Address</u> | <u>Phone #</u> |
|----|-----------------------------|----------------------------------------------------------------------|----------------|
| 1. | E&D Specialty Stands, Inc. | P.O. Box 700
North Collins, NY 14111 | 800-525-8515 |
| 2. | National Recreation Systems | 5021 Investment Drive
P.O. Box 11487
Fort Wayne, IN 46858-1487 | (219) 482-6023 |
| 3. | Outdoor Aluminum | P.O. Box 118
Geneva, AL 36340 | 800-225-4249 |
| 4. | Southern Bleacher Co., Inc. | P.O. Box One,
Graham, TX 76046 | 800-433-0912 |
- B. Other manufacturers seeking to be approved must submit product literature on the specified pressbox to the Architect to review a minimum seven (7) days prior to bid due date. Manufacturers shall also include a minimum five (5) projects of similar product type and project size within the last

three (3) years. Approval does not relieve the manufacturer of providing minimum criteria as specified.

- C. Qualified manufacturers must also provide proof of approval by the State of Michigan to manufacturer pressboxes in the State of Michigan.

2.2 PRESSBOX MATERIALS

A. FLOOR SYSTEM:

1. Floor Frame - Perimeter: 8" x 13 lb/ft WF Galvanized steel full perimeter floor frame with 8" I-beam cross members, 48" O.C. spacing.
2. Floor Frame - Longitudinal: 2" x 6" #2 SPF or better longitudinal floor framing, 16" O.C. spacing.
3. Bottom Board: 030 gauge one piece galvanized steel floor underpan, ½" CDX fire retardant plywood, .040 asphalt impregnated simplex bottom board floor sheathing vapor barrier. Continuous aluminum vents 48" O.C.
4. Insulation: 6" R19 fiberglass batt insulation with vapor barrier
5. Decking: Interlock Aluminum Decking, extruded aluminum allot 6063-T6, mill finish. Aluminum decking should be attached to steel floor frame with mechanical fasteners at end of plank and at intermediate supports. Factory install min. 16oz per sy indoor/outdoor carpet over aluminum decking using manufacturer approved adhesive. Carpet color shall be selected by Owner.
6. Floor Covering: 1/8" Armstrong Excelon vinyl composition tile. (Color: Cottage Tan)
7. Molding: 4" Resilient vinyl base (Standard Manufacturer Color)

B. WALL CONSTRUCTION:

1. Exterior Wall: 4"x4"x11ga square tubing with maximum span of 14 feet on front wall and maximum span of 6 feet on back wall and 4"x2"x14ga steel "cee" with maximum spacing of 5 feet for all walls with siding.
 - a. Steel framing shapes to meet one of the following ASTM's, A500 Grade A or B 45 ksi, A36 50ksi, A1011 CS Type B.
2. Ceiling Height: 8'-0" x 7'-10½" interior ceiling height, front to back.
3. Interior Wall: Framing to be steel galvanized studs (25 gauge) 1 1/4 inch x 3 5/8 inch at maximum 2 feet on center.
4. Wall Finish: 5/8" vinyl faced gypsum panel, Class A F.S.R.
5. Insulation: 3 ½" R-13, Kraft faced fiberglass batt insulation and vapor barrier. Batt or roll acceptable.
6. Siding: 26 gauge pre-finished steel R-Panel paneling as manufactured by MBCI, Signature 200 color series, or equal. Panels are attached with #12 TEK screws, 6" O.C. at the top and bottom of panels. Lap screws placed at each end of panels, at intermediate supports and at midpoint between supports with #14 TEK screws. All fasteners to be painted same color as exterior siding. Colors to be selected by Owner.
7. Base Molding: Vinyl 4 inches x 0.080 equal to PRO CB-35. Color to be selected by Owner.

C. ROOF SYSTEM:

1. Exterior Construction: 4 inch x 4 inch x 11 gauge square tubing with maximum spacing of 6 feet on center and 4 inches x 2 1/2 inches x 14 gauge steel "cees" with maximum spacing of 2 feet on center. Overhang to extend 18" over front wall; 6" over rear wall.
2. Insulation: 6" R-19 min., Kraft faced fiberglass building insulation and vapor barrier. Batt or roll acceptable.
3. Cornice: 26 gauge steel pre-finished to match metal siding.
4. Ceiling Panels: 24 inch x 24 inch x 5/8 inch acoustical ceiling tile (model #- USG Fissured 560) with USG grid main tee (model # DXL24), cross tee (model # DXL 216), wall angle (model # M7), wind clips and other components as manufactured by USG, or equal.

5. Roof: 1/8 inch four way steel plate roof, continuous welded seams coated with acrylic metal primer as manufactured by Coronado and 36 mils of acrylic roof coating as manufactured by Isothermal Protective Coatings, or equal. Plate is welded on both sides of rafters with 1-1/2 inch long 1/8 inch fillet welds on 12 inch centers.

D. DOORS

1. Exterior Doors: 36"x80" insulated aluminum/FRP with Special-Lite (as basis for design) door and exterior color shall match siding, aluminum threshold, 16" insulated/tempered window (safety glass), vinyl weather strips and heavy-duty retention chains. All voids in door shall be filled with Styrofoam. Doors shall be equipped with Schlage recessed commercial grade pulls and security cylinders with ability for interchangeable cores. Interior hardware shall include Schlage Exit Device with panic bar handle that allows for opening without grasping, twisting or turning.
2. Interior Doors: Interior hollow Birch Unit(s), 3'-0" wide x 6'-8" high. Hardware shall be Schlage. Handles shall be lever type that allow operation without tight grasping or twisting.

E. WINDOWS

1. Front Windows: Shall be aluminum extruded vertical slider with 1" double glazed fully tempered glass and screens. Milgard #5120 "Classic Series", AAMA LC-25 structural rating. 6" jamb for support shall separate each window and a maximum of 18" on each end.
2. Rear Windows: Shall be aluminum extruded vertical slider with 1" double glazed fully tempered glass and screens. Milgard #5120 "Classic Series", AAMA LC-25 structural rating. 6" jamb for support shall separate each window and a maximum of 18" on each end. Refer to drawings for size and quantity of windows.
3. Finish: Electrostatically applied acrylic enamel.

F. ELECTRICAL

1. Service Panel: Square D distribution panel with main disconnect rated at 100 amp capacity, 120/240 volt, 60hz single phase electrical service. Service provided by Others.
2. Receptacles: 125 volt/15 amp duplex spec. grade, heavy duty as noted on drawings. Exterior receptacles shall be encased in weather-proof electrical boxes. Wiremold series #5400 plug strips below scorer's table.
3. Lighting: (2) 4' tube fluorescent light fixtures with T8 lamps. Lithonia #M-240-PC1S with parabolic diffusers.
4. Circuits: All branch circuit wiring is minimum #12 THHN encased in EMT thinwall conduit.
5. Junction Boxes: Provide junction boxes and 1" conduit up 32" as required to rough in for communication and scoreboard controls under countertop, min. 5' O.C. Conduit shall be stubbed min. 1' below subfloor.

G. COUNTERTOP

1. 18" deep X 3/4" lauan grade plywood with 1-1/2" x 3" edge, surfaced with .060 plastic laminate, "Nevamar Neutra Matrix, or equal" with 3" wire maintenance grommets and caps 3' O.C. Countertop mount shall consist of 4" x 2" x 14 gauge steel cee on 4" x 4" x 11gauge square tubing.

2.3 FINISH HARDWARE

- A. Schlage based hardware locksets with security cylinders, closers and panic bars. Typical hardware to include continuous hinges, recessed pulls on exterior doors.
- B. Hardware Mounting Locations

1. Location of hardware
 - a. Locate finish hardware in accordance with the following schedule except where door manufacturer's standard required other placement. Consult Landscape Architects for any deviation from this schedule. All dimensions are to centerline.
 - b. Pull Plate - 42"
 - c. Push Plate - 42"
 - d. Door Knob - 38"
 - e. Deadlock - 48"
 - f. Bottom Hinge – Manufacturers standard
 - g. Top Hinge – Manufacturers standard
 - h. Center Hinge – Manufacturers standard
 - i. Kickplates – ¼" from door bottom to plate bottom
- C. DOOR CLOSERS: All door closers shall be of rack and pinion construction with cast iron cases, have key regulated valves, adjustable spring power, adjustable back check and adjustable closing and latching speeds. Install closers so that they are not visible from the outside.
- D. KICK PLATES: Kick plates shall be wrought ".050". Use 12" height by door width less 1-1/2" at single and less 1" at pair of doors. Products from any nationally recognized trim or lock manufacturer are acceptable. All plates shall be countersunk and installed with O/H sheet metal screws. No pan head screws will be accepted. All kickplates shall be beveled on three sides. Armor plate height, as scheduled.
- E. THRESHOLDS: Consult hardware sets for location and type. All thresholds shall be equal in length to full masonry opening and coped when frame is recessed. Cope all thresholds around door frame.
- F. PUSH AND PULL PLATES: Plates to be beveled on four sides. To be prepped and furnished with O/H sheet metal screws. No pan head screws.
- G. WEATHERSTRIP AND DOOR SWEEPS: Design and materials as scheduled. Reese, Hager, and Pemko approved.

KEYING: All cylinders shall have the ability to be keyed to Owner's existing Key System. Individual key sets shall be as directed by the Owner. Best representative to change construction cores to final cores.

PART 3 - EXECUTION

3.1 INSTALLATION OF HARDWARE

- A. A. Installation: Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for Custom Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Landscape Architect.
- B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, install each item completely and then remove and store in a secure place during the finished application. After completion of the finishes, re-install each item. Do not install surface-mounted items until finishes have been completed on the substrate.

- C. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- E. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant.

3.2 INSTALLATION OF PRESSBOX

- A. Install pressbox unit in accordance with manufacturer's installation procedures. Pressbox shall be installed plumb, level and secure.

3.3 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Lubricate moving parts with type lubrication recommended by manufacturer (graphite-type if not other recommended). Replace units which cannot be adjusted and lubricated to operate freely and smoothly as intended for the application made.
- B. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work site during the week prior to acceptance or occupancy to make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors.
- C. Instruct Owner's Personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.
- D. Upon completion of all work, contractor shall clean all surfaces i.e. windows, countertops and floors. Contractor shall also remove all shavings, stickers, dirt, debris, construction materials nuts, bolts etc.

END OF SECTION 13 3423

MELVINDALE-NORTHERN ALLEN PARK PUBLIC SCHOOLS

ATHLETIC FACILITY IMPROVEMENTS

BID PACKAGE #1

171739

DECEMBER 18, 2017

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ANGLE FRAME BLEACHERS - ELEVATED

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.
- B. Related Sections:
 - 1. Section 03 3000 Cast In Place Concrete
 - 2. Section 31 2000 Earthwork

1.2 SCOPE OF WORK

- A. The work under this section of the specifications shall consist of furnishing all labor, materials and equipment necessary to design and construct a Outdoor Welded Angle Framed Fixed Bleacher.
 - 1. 10 Row x 67.5 ft. long Welded Galvanized Steel Angle Frame Bleacher
 - 2. Provide for a 60 inch clear width Front Walkway Elevated 30 inches above grade.
 - 3. 8 inch rise x 24 inch tread spacing.
 - 4. Semi-closed decking arrangement.
 - 5. Anodized Aluminum Bench Seats and Risers.
 - 6. Mill finish footboards, steps, and walkways.
 - 7. One (1) Aisle w/Anodized 2-line Aluminum Handrails
 - 8. One (1) Wheelchair ramps w/ 8 wheelchair spaces(as shown)
 - 9. Approx. 400 net seating capacity elevated bleacher
 - 10. 4 inch thick reinforced concrete flatwork w/ min. 6 inch sand base.

1.3 QUALITY ASSURANCE

- A. Warranty Guarantee: Product shall be guaranteed for five (5) years on the structure and three (3) years on the finish and labor beginning on the Date of Substantial Completion. This warranty excludes any other defects resulting from abnormal use in service, accidental or intentional damage or any occurrences beyond Manufacturer's control.
- B. Manufacturer Qualifications: Shall specialize in spectator seating with a minimum 10 years experience in design, manufacturing and installation of bleacher seating. Manufacturer shall have a local representative within a 200 mile radius to insure proper quality control during construction. Welders must be AWS certified. Bleacher shall be designed under the supervision of a registered Professional Engineer.
- C. Installer Qualifications: Factory trained and Experienced in the proper installation of bleacher seating.
- D. General: All components shall be provided by one manufacturer and shall be specifically designed for the use required of the.
- E. Insurance Requirements: Each Bidder shall provide a certificate of Product Liability Insurance, issued by the manufacturer, in the minimum amount of \$500,000, and acceptable to the Owner. Certificate does not need to be submitted with bid but must be submitted prior to award of Contract by the Owner.

1.4 SUBMITTALS

- A. Manufacturer's Product Data: Submit manufacturer's descriptive product data for project
- B. Shop Drawings: Manufacturer shall submit shop drawings sealed by a registered Professional Engineer and schedules for type, location, quantity and details of steel and aluminum components required for projects.
 - a. Seating plan indicating aisles, walkways, seating section and exits
 - b. End elevation indicating riser and row depth, deck configuration, railings, size and framing members and walkways

1.5 SITE CONDITIONS

- A. Existing underground utility lines shall be located by Owner prior to excavation.
- B. A soil boring report, furnished by the Owner, shall be made available to the Contractor.

PART 2 - PRODUCTS**2.1 APPROVED MANUFACTURERS:**

- A.

	<u>Company</u>	<u>Address</u>	<u>Phone #</u>
1.	Southern Bleacher Co., Inc.	P.O. Box One, Graham, TX 76046	800-433-0912
2.	E&D Specialty Stands, Inc.	P.O. Box 700 North Collins, NY 14111	800-525-8515
3.	National Recreation Systems	5021 Investment Drive P.O. Box 11487 Fort Wayne, IN 46858-1487	219-482-6023
4.	Outdoor Aluminum	P.O. Box 118 Geneva, AL 36340	800-225-4249
- B. Other manufacturers seeking to be approved must submit product literature on the specified pressbox to the Architect to review a minimum seven (7) days prior to bid due date. Manufacturers shall also include a minimum five (5) projects of similar product type and project size within the last three (3) years. Approval does not relieve the manufacturer of providing minimum criteria as specified.
- C. Qualified manufacturers must also provide proof of approval by the State of Michigan to manufacturer pressboxes for the State of Michigan.

2.2 DESIGN CRITERIA

- A. Design Load:
 - 1. Live Load: 100 psf gross horizontal projection.

2. Dead Load: 6 psf seat, footboard, riser, etc.
3. Lateral Sway Load: 24 lbs/lf seat plank
4. Perpendicular Sway Load: 10 plf seat plank.
5. Live Load of Seat and Tread Plank: 120 lbs/lf
6. Guardrail: 200 lbs/lf concentrated in any direction and 50 lbs/lf horizontal.

2.3 MATERIALS

A. Framework

1. Galvanized Steel: Structural fabrication with ASTM-A36 steel. Shop Connections are seal welded. After fabrication all steel is hot-dipped galvanized conforming to ASTM-A123 specifications.
2. Aluminum: Structural fabrication with aluminum alloy 6061-T6, mill finish.

B. Extruded Aluminum

1. Seat Plank: Extruded aluminum alloy 6063-T6, clear anodized 204R1, AA-M10C22A31, Class II.
2. Tread Plank, Riser Planks: Extruded aluminum alloy 6063-T6, mill finish.
3. Joint Sleeve Assembly: Extruded aluminum alloy 6063-T6 mill finish.

C. Rise and Depth Dimensions: Vertical rise and horizontal depth per row: 8 inches x 24 inches. Seat is 17 inches above its respective tread.

D. Framework: Prefabricated angle or aluminum tubing bleacher frames are spaced at 6' intervals and connected by cross braces.

E. Seats: Nominal 2 x 10 anodized aluminum plank, with 2 x 10 aluminum end caps.

F. Treads: Nominal 2 x 11 mill tongue and groove tread planking with 2x11 end caps for elevated units.

G. Risers: 1 x 6 anodized finish aluminum plank.

H. Joint Sleeve Assembly: Included on 33' long bleachers and optional on large continuous units to maintain true alignment in joining two planks together.

I. Steps: Frames with 2 x 12 mill aluminum plank.

H. Guardrails: Each line with end plugs at ends of straight runs and elbows at corners. Secured to angle rail risers by fasteners. Back top rail to be 42" inches above its adjacent seat. Side (and front) top rails to be 42 inches above seats (and front walkway). A chainlink fence shall be secured a maximum 18" on center. Bleacher Manufacturer shall also extend railing and chainlink fence in front in front of bleacher to grade. Bottom of rail to grade shall be +/- 2 inches.

2.4 MATERIALS/FINISHES

A. Accessories:

1. Channel End Caps: Aluminum alloy 6063-T6, clear anodized 204R1, AA-M10C22A31, Class II.
2. Hardware:
 - i. Bolts, Nuts: Hot-dipped galvanized or cadmium plated.
 - ii. Hold-Down Clip Assembly: Aluminum alloy 6063-T6.
3. Guardrails: Anodized Pipe: 1.66 O.D. Optional: chainlink fencing.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install bleacher unit in accordance with manufacturer's installation procedures.
- B. Clean up and restore the site upon completion removal of all shavings, dirt, debris, construction materials i.e. nuts, bolts etc.
- C. Prior to final acceptance, Bleacher Contractor shall be responsible to clean or replace foot planks that become stained or oxidized.

END OF SECTION 13 3510

GRANDSTANDS – LEG TRUSS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.
- B. Related Sections
 - 1. Section 03 3010 Portland Cement Concrete
- C. Section Includes
 - 1. Steel Structure
 - 2. Aluminum Decking System
 - 3. Concrete Strip Footing Foundation and Flatwork
 - 4. Perimeter Guard Railings
 - 5. Star and Ramp Exits

1.2 SCOPE

- A. Provide and install permanent semi-closed deck leg truss grandstand with net seating capacity of 1,484 seats on the home side.
- B. Provide and install steel grandstand understructure including galvanized steel stringers and I-beam columns, concrete pads and thickened slab concrete.
- C. Provide and install all anodized aluminum handrails, finish aluminum stairs, galvanized chain link guard railing and trim.
- D. Provide for handicap seating and companion seating to be accommodated within the seating area.
- G. System Description: Provide labor (see labor rates), material. Equipment and supervision necessary to complete installation of permanent steel grandstand, including the following:
 - 1. Steel Structure
 - 2. Decking System
 - 3. Concrete Foundation
- H. Minimum Criteria
 - 1. 10, 11, and 13 rows x 222 ft. long grandstand
 - 2. 8 inch rise x 24 inch row-to-row spacing
 - 3. 6 ft. wide front cross walk elevated 42 inches.
 - 4. Galvanized Leg-Truss Construction
 - 5. Colored Aluminum Extruded Benches and Risers
 - 6. Semi-closed Mill Finish Aluminum Extruded Footplanks
 - 7. Mill finish aluminum Extruded aisle step extensions w/black contrasting aisle step nosing.
 - 8. Welded Anodized Aluminum 2 line aisle hand rails.
 - 9. Perimeter guard Railings:
 - Galvanized Steel Rail Risers

- Anodized Aluminum Upper and Lower Pipe Frames
 - Galvanized Chain Link Fabric.
10. Mill Finish Extruded aluminum stairs, landings, ramps as shown on drawings.
11. (14) wheelchair spaces placed within rows 1 and 2.
12. Provide all aluminum edge trip for exposed aluminum ends.

1.3 QUALITY ASSURANCE:

- A. Warranty Guarantee: Product shall be guaranteed for five (5) years on the structure and three (3) years on the finish and labor beginning on the Date of Substantial Completion. This warranty excludes any other defects resulting from abnormal use in service, accidental or intentional damage or any occurrences beyond Manufacturer's control.
- B. Manufacturer Qualifications: Shall specialize in spectator seating with a minimum 10 years experience in design, manufacturing and installation of bleacher seating within the State of Michigan and shall be AISC certified. Manufacturer shall have a local representative within a 200 mile radius to insure proper quality control during construction. Welders must be AWS certified. Bleacher shall be designed under the supervision of a registered Professional Engineer.
- C. Installer Qualifications: Factory trained and Experienced in the proper installation of bleacher seating.
- D. General: The grandstand shall be designed, fabricated and erected by the same manufacturer/supplier.
- D The proposal shall include a listing of sub-contractors, major material supplier, and standards and specifications for materials to be used.
- F. Product Liability Insurance - Each Bidder shall provide a certificate of Product Liability Insurance, issued by the manufacturer, in the minimum amount of \$1,000,000.00 and acceptable to the Owner. Certificate does not need to be submitted with bid but must be submitted prior to award of Contract by the Owner.

1.4 QUALIFICATIONS OF WORKMAN:

- A. Provide at least one person who shall be thoroughly trained and experienced in the skills required, who shall be completely familiar with the design and application of work described for this Section, and who shall be present at all times during progress of the work of this Section and shall direct all work performed under this Section.
- B. For actual construction of the specified items, use only personnel who are thoroughly trained and experienced in the skills required.

1.5 SITE CONDITIONS

- A. Existing underground utility lines shall be located prior to excavation.
- B. A soil boring report, furnished by the Owner, shall be made available to the Contractor.
- C. Contractor shall field verify elevation and location of existing pressbox stair and landing.

1.6 SUBMITTALS

- A. Manufacturer's Product Data: Submit manufacturer's descriptive data for project.
- B. Shop Drawings: Manufacturer shall submit shop drawings and structural calculations sealed by a registered Professional Engineer and schedules for type, location, quantity and details of steel and aluminum components required for projects.
 - 1. Seating plan indicating aisles, walkways, seating section and exits
 - 2. End elevation indicating riser and row depth, deck configuration, railings, size and framing members and walkways

1.7 DESIGN CRITERIA AND CERTIFICATION:

- A. The grandstands shall, in general, be designed in accordance with all applicable provisions of the State of Michigan. The structural design shall be in accordance with accepted engineering principles and shall comply with the requirements given in;
 - 1. NFPA
 - 2. American Institute of Steel Construction Design Manual
 - 3. BOCA National Building Code
 - 4. American's with Disabilities Act (for wheelchair accessibility)
- B. The Contractor shall assume complete design responsibility for the work specified herein. He shall furnish drawings bearing the seal of a Registered Professional Engineer to the Construction Manager.
 - 1. Use a flexible design wherever possible.
- C. Foundation design shall be based on the soil data provided in this document. Bearing capacity shall be a min. 2000 psi or per soil boring report.
- D. Design Loads:
 - 1. Dead Load - 6 lbs per S.F (seat and boards, risers, steel frame, etc.)
 - 2. Live Load - 100 lbs per S.F (to structural member)
 - 120 lbs per L.F. (seat and footboards)
 - 3. Wind - 30 lbs per S.F. (ANSI A58.1) (on project surface)
 - 4. Sway - 24 lbs per L.F. (parallel per ft. of seat parallel to seat run)
 - 10 lbs per L.F. (perpendicular per ft. of seat)

1.8 WARRANTY:

- A. Permanent Grandstand shall be under warranty for a period of one year beginning the date of Substantial Completion for Projects installed by Manufacturer. The Grandstand is to be warranted free from defects in materials and workmanship in the course of manufacturer. This warranty excludes any other defects resulting from abnormal use in service, accidental or intentional damage or any occurrences beyond manufacturer's control.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Grandstands shall be from one of the following manufacturers:

- | | |
|---------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| 1. Southern Bleacher Co., Inc.
P.O. Box One
Graham, TX 76046
(800) 433-0912 | 4. E & D Specialty Stands, Inc.
P.O. Box 700
North Collins, NY 14111
(800) 525-8515 |
| 2. National Recreation Systems
5021 Investment Drive
Fort Wayne, IN 46858
(888) 568-9064 | 5. Outdoor Aluminum
P. O. Box 118
Geneva, Alabama
(800) 225-4249 |
| 3. Dant-Clayton Corporation
536 8 th Street
Columbus, IN 47201
(812) 376-6135 | |

B. Bids from manufacturers other than companies listed will not be considered unless written approval is obtained a minimum of 10 days prior to date of bid receipt.

C. Product Description:

Leg-Truss Permanent Grandstand Design:

1. Leg-Truss Design: Gross Seating capacity of 1,484 with, 10,11, and 13 rows, and 222 feet, long.
2. Vertical columns are placed 6 feet on center laterally.
3. Stringers are wide flange with steel angle rise and depth fabrication, and are placed 6 feet on center.
4. Front Walkway:
 - a. Clear width 60" inches.
 - b. Elevated 3.5' feet above grade at benchmark.
5. Entry stairs to be firmly anchored to uniformly poured concrete bases.
 - a. Stair rise: - 4" inches per Michigan Building Code with aluminum closure and contrasting aluminum stair nose.
 - b. Stair tread depth: - 12 inches per Michigan Building Code.
 - c. Guardrails on Stair to be 42" inches above leading edge of step with intermediate rail spacing at 34" inches.
 - d. Stairs to have handrail extension. The handgrip portion of handrails shall not be less than 1-1/2 inches or more than 2 inches in cross-sectional dimension or the shape shall provide an equivalent gripping surface. The handgrip portion of handrails shall have a smooth surface with no sharp corner. The top of handrails and handrail extensions shall be placed not less than 34 inches or more than 38 inches above the nosing of treads and landings. Handrails shall be continuous the full length of the stairs and shall extend in the direction of the stair run not less than 12 inches beyond the bottom riser. Ends shall be returned or shall terminate in newel posts or safety terminals.
6. Aisles:
 - a. Aisles with seating on both sides to have 34-inch high handrail with intermediate rail at approximately 22 inches above tread.

- b. Anodized aluminum handrails with rounded ends are discontinuous to allow access to seating through a space 22 inches (min.) to 36 inches (max.).
- 7. Decking:
 - a. Rise per row 8 inches, depth per row 24 inches.
 - b. Each seat 17 inches above its respective tread.
 - c. Mill Aluminum Closed Decking Arrangement: Closed Deck
- 8. Guardrailing: To be at all sides of bleacher, entry stairs and ramps, portals, and landings. Railing to be anodized aluminum with end plugs at ends of straight runs and/or elbows at corner. All guardrails shall be secured to angle rail risers by galvanized fasteners. Railing shall be 42" above walkways and entrances. Railing shall be 42" above any adjacent seat. Guardrailing on sides and back shall include 9 gauge aluminized chain link fencing fastened in place with galvanized fasteners and aluminum ties.
- 9. Ramps:
 - a. Slope: 1 in 12
 - b. Guardrail to be 42 inches above ramp with 9 gauge aluminized chainlink fence and 2 x 6 toeboard.
 - c. Handrail: Ramps to have handrail extension. The handgrip portion of handrails shall not be less than 1 1/2 inches or more than 2 inches in cross-sectional dimension or the shape shall provide an equivalent gripping surface. The handgrip portion of handrails shall have a smooth surface with no sharp corners. The top of handrails and handrail extensions shall be placed not less than 34 inches or more than 38 inches above the ramp surface. Handrails shall be continuous the full length of the ramp and shall extend in the direction of the ramp not less than 12 inches beyond the end of the ramp. Ends shall be returned or shall terminate in newel posts or safety terminals.
- 10. Handicap provision:
 - a. Quantity of wheelchair spaces: Fourteen (14)
 - b. Riser area adjacent to wheelchair spaces to have intermediate construction so 4 inch sphere cannot pass through opening.
- 11. Materials/Finishes:
 - a. Substructures:
 - i. Structural shapes meet one of the following ASTM specifications: A36, A36/A572 grade 50, A572 grade 50, A529-50, or A500 grade B.
 - ii. Shop connections are seal welds.
 - iii. After fabrication, all steel is hot-dipped galvanized to ASTM-A-123 specifications.
 - iv. Painted steel finish is unacceptable.
 - b. Extruded Aluminum:
 - i. Seat Planks, Stanchions, Riser Planks, and Railing are extruded aluminum alloy, 6063-T6 with clear anodized 204R1, AA-M10C22A31, Class II finish
 - ii. Tread planks are extruded aluminum alloy 6063-T6 mill finish
 - iii. Railing: Extruded aluminum alloy, 6063-T6 clear anodized 204R1, AA-M10C22A31, Class II.
 - c. Accessories:
 - i. Channel End Caps: Aluminum alloy 6063-T6, clear anodized 204R1, AA-M10C22A31, Class II. Polyethylene end cap is unacceptable.
 - ii. Cast End Caps: Aluminum 319 alloy, cast finish. (Required for back rest and RS plank only)
 - iii. Hardware:
 - (1) Bolts, Nuts: Hot-dipped galvanized or mechanically galvanized.
 - (2) Hold-down Clip Assembly: Aluminum alloy 6005A-T6, mill finish.
 - (3) Structural Hardware: Equal to or greater than hot-dipped galvanized ASTM-A307. No connections utilizing high strength bolts are classed as slip critical.

- iv. Aisle Nose and Stair Nose: Aluminum alloy, 6063-T6, non-skid black powder coat finish.

2.2 CAST-IN-PLACE CONCRETE FOUNDATION

- A. All cast-in-place concrete work shall comply with the A.C.I. Building Code requirement for reinforced concrete and with the A.C.I. Manual of Concrete Practice latest edition. Cast-in-place concrete shall have a minimum ultimate compressive strength of 3000 psf at the end of 28 days.

2.3 STEEL SUPPORT STRUCTURE

- A. Steel support structure shall be designed and certified by a registered Engineer.
- B. All structural fabrication shall be with ASTM-A36 steel. All shop connection shall be seal welded. After fabrication, all steel shall be hot-dipped galvanized to ASTM-123 specifications.
- C. Manufacturer to be AISC Certified.

2.4 ALUMINUM

- A. All exposed aluminum components shall be 6063-T6 aluminum alloy, clear anodized 204 R1, AA-M10C22A31 having a minimum thickness of 0.075 inches.
- B. Seat planks shall be nominal 2" X 10" continuous extruded anodized 204 R1 aluminum with channels in underside for concealed bolt clips; grooved top surface.
- C. Foot planks shall be nominal three (3) 2" X 8" aluminum, mill finish, with channels in underside for concealed bolt clips; grooved top surface.
- D. Provide anodized channel end caps at all exposed plank ends.
- E. Bolt clips shall be manufacturer's standard, 4-way adjustable with aluminum clips and galvanized steel bolt and nut.
- F. Aluminum riser board shall be nominal 1" x 10" under each seat.
- G. Riser board shall be extruded anodized aluminum plank. Kynar powder coated. Color to be selected by Owner from manufacturer standard colors.
- H. Nominal 2" x 10" riser plank shall be 1 7/8" x 9 1/2" actual dimension.

2.5 GUARDRAILS

- A. Shall be capable of 50 lbs. per lineal foot horizontal load and 100 lbs. lineal foot vertical load.
- B. Side and back guardrailing shall be 9 gauge chain link fencing with top and bottom rail. Front guardrail shall be 3-line railing with 9 gauge chain link fence. All fence fabric shall be 2" aluminized mesh secured 18" on center. Bleacher Manufacturer shall also extend railing and chainlink fence in front in front of bleacher to grade. Bottom of rail to grade shall be +/- 2 inches.
- C. Guardrails shall be of 1 5/8", 6061-T6 alloy, anodized aluminum pipe. Joints shall be made with fittings. Plug open ends with flush fitting closures.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Prior to installation, examine the site conditions to verify that on site preparation work has been completed.
- B. Verify soil bearing pressure per Soils Report and correct if required.

3.2 INSTALLATION

- A. Install the grandstand bleacher in accordance with the manufacturer's written procedures.
- B. Protect all adjacent work and restore or replace any adjacent work removed or damaged by the grandstand construction.
- C. Clean up and restore the site upon completion.

END OF SECTION 13 3520

MELVINDALE-NORTHERN ALLEN PARK PUBLIC SCHOOLS

ATHLETIC FACILITY IMPROVEMENTS

BID PACKAGE #1

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FIELD COMMUNICATION BOXES

PART 1 - GENERAL

1. SUMMARY

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.

2. SCOPE

- A. Furnish all labor, materials, and equipment necessary to install pre-manufactured synthetic turf field communication boxes.

3. GUARANTEE AND SERVICE:

- A. The completed system shall be guaranteed to be free from all defects for a period of manufacturer's warranty/guarantee or one (1) year from the date of final acceptance, whichever is greater. Any defects or system malfunctions shall be immediately corrected at not cost to the Owner for the warranty/guarantee period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Furnish and install synthetic turf communication boxes as detailed. Refer to plans to quantity and locations.
- B. Communication boxes shall be from one of the following (or approved equal)
 - 1. Sportsfield Specialties: Model 3500 (18"x30")
 - 2. SportsEdge: Model SEF900 (18"x30")

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install equipment in accordance with manufacturer's instructions.

END OF SECTION 27 5119

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EARTHWORK - TURF

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the provisions of the other parts.
- B. Section Includes:
 - 1. Excavation
 - 2. Grading
 - 3. Backfill and Fill

1.2 SCOPE

- A. Furnish approved labor, materials, equipment, transportation, and services required to complete all earthwork as indicated on the drawings and specified herein The Base Bid includes all earthwork and grading to provide a subgrade for other improvements. Adjustment of grades will be permitted, providing the overall grading concept and the positive drainage swales are maintained.

1.3 QUALITY ASSURANCE

- A. Excavation team shall be established and experienced with a minimum of 5 years experience constructing athletic fields.

1.4 EXAMINATION OF SITE

- A. The contractor is expected to visit the site to determine all conditions to be encountered, protect improvements on adjoining properties, as well as those on the owner's property, and to restore any improvements damaged by his work to their original condition, as acceptable to the owner or other parties or authorities having jurisdiction.

1.5 SAFETY CODES AND STANDARDS

- A. Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

1.6 LINES AND GRADES

- A. The plans indicate lines, grades and elevations of the finish work. In general, areas to be turfed shall be excavated and/or filled, and graded to the bottom elevations of drainage aggregate.

1.7 DEWATERING

- A. The contractor shall perform all work so as to permit the site to be free draining at all times and to prevent ponding. Contractor shall provide positive drainage for the entire site during the course of construction to eliminate standing water in excavated areas.

1.8 DEBRIS

- A. All debris is to be disposed off Owner's property unless otherwise directed.
- B. Debris may not be buried over existing sewers or water mains.
- C. All debris must be removed on a daily basis.

PART 2 - PRODUCTS

2.1 BACKFILL AND FILL MATERIALS

- A. Backfill shall be excavated soil material, free of rock or gravel larger than 2" in any dimension, debris, waste, frozen materials, vegetable matter, organic matter, and other deleterious matter. Existing materials may be used for backfill, provided no silt is mixed with material. Backfill consists of placement of acceptable soil material in layers, in excavations, to required subgrade elevation, for each area classification listed below.
- B. Fill Material: Fill material shall be clean, hard, durable, uncoated particles of sand or sand gravel mixture, provided that there shall be a substantial excess of sand-screenings.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Excavation consists of removal of material encountered to obtain required subgrade elevations.
 - 1. Excavation for Trench: Cut trench to cross-sections and grades as shown. Deposit excavated materials a sufficient distance from the edge of trench to prevent cave-ins or material from sliding into ditch. Keep trench free of leaves, sticks, and other debris until final acceptance of work.
 - 2. Removal of Unsatisfactory Soil Materials: Excavate unsatisfactory soil materials encountered that extend below required elevations, to additional depth directed by the Landscape Architect. See geotechnical evaluation report. All organic matter within the synthetic turf footprint shall be removed. See Soil Borings report for topsoil depth.
 - 3. Material Storage: Place excavated materials classified as unsatisfactory fill materials where directed by Owner's geotechnical consultant.
 - 4. Stability: Slope sides of excavations over five feet (5') deep to angle of repose of material excavated; otherwise shore and brace where sloping is not possible either because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in a safe condition until completion of backfill by scaling, benching, shelving, or bracing. Take precautions to prevent slides or cave-ins when excavations are made in locations adjacent to backfill excavations, and when sides of excavations are subjected to vibrations from vehicular traffic or the operation of machinery or any other source. Remove soft or unstable soil below finish grade elevations and backfill such voids with compacted fill material.

3.2 DRAINAGE SWALES

- A. Swale Preparation
 - 1. Contractor shall provide positive drainage swales to all existing and proposed drainage structures as shown. The high point of the swale between all structures shall allow for proper fall and drainage.

3.3 BACKFILL AND FILL MATERIALS

A. Surface Preparation

1. Remove vegetation, debris, unsatisfactory soil materials, obstruction and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break up sloped surfaces steeper than one (1) vertical to four (4) horizontal so that fill material will bond with existing surface. When the existing ground surface has a density less than that specified under "Compaction" (3.2 A 2) for the particular area classification, break up ground surface, pulverize, and compact to the required depth and percentage of maximum density.
2. Compaction: Perform compaction of soil materials for fills and backfills using suitable soil compaction equipment for materials to be compacted and work area locations. Control soil compaction during construction for compliance with percentages of maximum density specified for each classification. All compaction tests shall be in accordance with ASTM D1557 or AASHTO T180 C Modified Proctor Method.
3. Placement And Compaction: Place backfill materials in layers not more than eight inches (8") in loose depth. Before compaction, moisten or aerate each layer, as necessary, to provide the optimum moisture content. Compact each layer to required percentage of maximum density for each area classification. Do not place backfill or fill material on surfaces that are muddy, or frozen, or contain frost or ice. Thoroughly compact all fill and backfill by rolling each layer, following spreading, as closely as possible. Roll the areas in equal amounts in two directions. Provide compaction equipment or type best suited to achieve the desired results with the type of soil. In general, use sheeps foot and/or tamping type rollers on soils of a cohesive type; pneumatic wheeled or vibrating rollers on granular fill material, all as approved by the Landscape Architect. Operate compacting equipment on each layer until the entire area has been thoroughly and uniformly compacted to the required density.
4. Maximum Density Requirements: Provide not less than the following percentages of maximum density of the same soil material compacted at optimum moisture content, for the actual density of each layer of soil material in place. Any soils found unsuitable for specified compaction requirements shall be removed as directed by Owner.
5. Lawn or Unpaved Areas: Compact top six inches (6") of subgrade and each layer of backfill or fill material at eighty-five percent (85%) maximum density.
6. Grading: Preparation of subgrade: Rough grade all areas within the limits of site grading under this section, including adjacent transition areas. The rough grade shall be compacted as required. Shape the surface of future lawn areas to the line grade and cross-section with the surface not more than 0.10 feet above or below a subgrade elevation. Take extreme care in the grading of swale areas to insure free movement of surface runoff. Ponding shall be non-existent or at a minimum.

3.4 FINISH GRADING:

A. Sub-Soil Preparation:

1. Fine grade sub-soil systematically to eliminate uneven areas and low spots. Remove debris, roots, branches, stones, etc., in excess of two inches (2") in size. Remove sub-soil which has been contaminated with petroleum products.
2. Bring sub-soil to required levels, profiles and contours suitable for receiving the required finish surfaces. Make changes in grade gradual; blend slopes into level areas. Maximum slope 4:1 unless otherwise indicated.
3. Cultivate sub-grade to a depth of six inches (6") where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil.
4. Compact sub-soil at the following percentages to a depth of 12 inches:
a 85% Modified Proctor where topsoil is to be placed.

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END OF SECTION 31 2010

GEOTEXTILE FABRIC

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.

1.2 SCOPE

- A. The work under this section shall consist of furnishing all labor, materials and equipment for the installation of the geotextile fabric.

1.3 SUBMITTALS

- A. Manufacturer's Literature: Furnish to Landscape Architect, when required, copies of manufacturer's specifications, and installation instructions for geotextile fabric. Include photographs, catalogue cuts, samples as may be required to show compliance with these specifications.

PART 2 - PRODUCT

2.1 GEOTEXTILE FABRIC

- A. The product shall be AMOCO CEF2006, Mirafi - 600x, LINQ Industrial Fabrics - GTF-300, CSI Geoturf - W315 or an approved equivalent.
- B. The geotextile shall be of woven construction and consist of long-chain polymeric yarns. The yarns must be composed of at least 95% propylene or ester polymers. The fibers shall be produced in a manner which achieves a stable network. The geotextile shall conform to the mechanical and hydraulic property requirements listed below:

MINIMUM AVERAGE PROPERTY	VALUE	UNIT	TEST PROCEDURE
Grab Tensile Strength	315	lbs.	ASTM D-4632
Grab Tensile Elongation	15	%	ASTM D4632
Wide Width Tensile	175/175	lbs/in	ASTM D4595
Wide Width Elongation	15/8	%	ASTM D4595
Mullen Burst	600	Psi	ASTM D3786
Puncture	145	lbs	ASTM D4833
Trapezoidal Tear	120	lbs	ASTM D4533
UV Resistance	70	% @ 500 hr	ASTM D4355
Apparent Opening Size (max)	40	AOS	ASTM D4751
Permittivity	.055	1/sec	ASTM D4491
Flow Rate	4.0	gpm/ft2	ASTM D4491

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The geotextile fabric shall be furnished and stored in a wrap which will protect the geotextile fabric from ultraviolet radiation and abrasion. The geotextile fabric shall be covered with the appropriate soil cover

within two weeks of its placement.

- B. Should the geotextile fabric be damaged during construction, the torn or punctured section shall be repaired by placing a piece of fabric that is sufficiently large enough to cover the damaged area plus two feet (2') of adjacent undamaged geotextile fabric in all directions.
- C. Fabric shall be installed on dry soil as per manufacturer.
- D. Overlap the fabric as recommended by the manufacturer.
- E. Installation and Unit Price shall include overlap quantities.

END OF SECTION 31 3219

AGGREGATE DRAINAGE LAYER

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.
- B. Related Sections:
 - 1. Section 31 2010 Earthwork – Turf

1.2 SCOPE

- A. The work under this section of the specification shall consist of furnishing all labor, materials and equipment to produce, place, spread, compact and finish to proper grade and cross section all aggregate base courses according to the drawings and specifications.

1.3 QUALITY ASSURANCE

- A. Contractor shall have previously installed ten (10) artificial infill turf bases for turf fields larger than 80,000 square feet in the last three (3) years.
 - 1. The contractor is responsible for subgrade fine grading, installation of geotextile fabric, installation of field drainage system, installation of the perimeter nailing system, installation of field irrigation system, and installation of the dynamic stone base.
- B. Firms must have been in business under the same ownership for at least three years, and shall have been installing similar sports fields for that entire period.
- C. Contractor shall provide a sieve analysis prior to placement for every 150 ton of stone delivered to site.
- D. The synthetic turf manufacturer/installer shall perform an inspection of the field base onto which the synthetic turf system is to be installed to examine the finished surface for required compaction, permeability and grade tolerances. Earthwork contractor is responsible for correcting deficient items noted by the turf manufacturer/installer prior to acceptance. The turf installer will accept the aggregate stone base in writing when the Owner's representative provides test results for compaction, permeability and planarity that are in compliance with the project plans and specifications. After any discrepancies between the required materials, application and tolerance requirements noted have been corrected, the synthetic turf installer should submit a written certification of acceptance of the base for installation of synthetic turf system.

1.4 SUBMITTALS

- A. Submit to the Landscape Architect a sieve analysis of the proposed stone to be installed. Sieve analysis shall be dated within 14 days of submission.

1.5 ACCEPTABILITY OF THE WORK

- A. Grade: Grade conformance tests shall be conducted on the entire surface. The surface shall have positive drainage of 0.50% inclination.
- B. Planarity: After completion of the compacting operations, the compacted aggregate base shall be tested with a 10' straightedge. Measurements shall be made perpendicular to and across the field at a distance

not to exceed 25' feet. The grade will not vary by 1/8" from proposed grades, elevations and slopes provided.

- C. The grade of the aggregate base shall be evaluated with a "string test". The contractor shall identify, with paint, every 5 yd line, in-bound lines, side line, touch line and end lines.
- D. Aggregate shall be tested as per ASTM F1551-09 at a minimum of 8 locations after final grade as been achieved and accepted.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aggregate base material shall conform to specifications for 100% crushed 100% limestone and shall be placed and compacted to the minimum depth shown on plans. Crushed concrete, slag, etc. shall not be allowed. DOT standard classifications do not conform. Modifications of standard DOT aggregate classification maybe required to meet specification. On-site mixing will not be an acceptable method for providing this material.

Aggregate Sieve Analysis

Percent Passing

	Base Material	Finishing Stone (Not to exceed 1" compacted depth)
1 1/2"	90-100	
1"	75-100	
3/4"	65-95	100
3/8"	40-75	85-100
1/4"	25-65	75-100
No. 4	15-60	60-90
No. 8	0-40	35-75
No. 16	0-20	10-55
No. 30	0-7	0-40
No. 60	0-5	0-15
No. 100	0-3	0-8
No. 200	0-2.5	0-2
LBW	Maximum 2.5	Maximum 2

- B. The hydraulic conductivity of the aggregate shall be such that is capable of draining the entire synthetic surface at a minimum of 10"/hr for the carpet and 14"/hr including aggregate drainage stone with perforated under drain system acting as the main water displacement conductor. The aggregate shall maintain its finished grade elevations migration of fines and subsequent loss of finished tolerances will not be accepted.
- C. Material shall be tested by a testing agency selected by the Owner to ensure compliance with the submitted documentation (ASTM D422 particle size analysis and ASTM F1551-09/DIN 18-035:6, permeability to water). A minimum of 8 tests shall be performed at random locations selected by Owner's representative.

PART 3 - EXECUTION**3.1 SUB-GRADE CONSTRUCTION**

- A. The sub-grade shall be so constructed as to have uniform stability for a width at least equal to that of the proposed improvements plus of the proposed anchoring system. It shall be brought to an elevation and cross section such that, after being rolled, the surface will be at the required elevation. At the time the sub-grade is prepared, the fill area shall have been constructed to the full width and to at least the elevation of the finished sub-grade.
- B. The material present in the next six (6) inches below the elevation of the sub-grade shall be scarified, mixed and recompact, or otherwise treated to produce a uniform condition. Stones over four (4) inches in size shall be removed from the loosened portion of the sub-grade and disposed as directed by the project representative.
- C. Depressions that develop during the following shall be filled with suitable material, and the rolling shall continue until the sub-grade is uniformly firm, properly shaped and substantially true to grade and cross section. It shall be so maintained until the pavement is place.
- D. Material, other than sand, which will not compact readily under roller shall be removed and replaced with material which will compact readily and that portion of the sub-grade shall be rolled again.
- E. The rolling of the sub-grade shall extend for at least twelve (12) inches outside of each edge of the proposed turf boundaries when possible. Piles or ridges of earth or material that would seriously interfere with the operations of finishing the pavement shall not be left on the shoulders.
- F. During the process of construction sub-grade, the soil shall be maintained in a condition sufficiently moist to facilitate compaction and produce a firm, compact surface.
- G. If, in the preparation of the sub-grade, it becomes necessary to excavate below the elevation of the earth shoulders, ditches or drains shall be provided at frequent intervals to permit ready drainage of surface water from sub-grade to side ditches.
- H. If ruts or other objectionable irregularities form in the sub-grade during construction, the Contractor shall reshape and re-roll the sub-grade before the drainage course is laid. The material used for filling ruts or other depressions shall be of such character as to make it equally desirable for sub-grade purposes as the material presented in the sub-grade.
- I. When the sub-grade is being prepared for placement as an aggregate base course, the elevation of the most finished surface, at the time the next layer is placed, shall not vary by more than 0.02 foot above or below the prescribed elevation at any point where measurement is made.

3.2 AGGREGATE DRAINAGE COURSE

- A. Base course construction shall proceed as follows only after the Architect has approved the sub-grade construction and the gravel tests.
- B. The base shall be constructed in layers of not more than three (3) inches (75mm) compacted thickness when conventional rolling equipment is used.
- C. If vibratory or other approved special equipment is used, the thickness of every compacted layer may be increased to a maximum of eight (8) inches (200mm).
- D. The finished surface of any aggregate base course shall not vary more than 1/8" from the elevations, grades and cross sections on the drawings.

- E. Compacted stone base dimensions shall be a minimum of 8".
- F. It shall be the contractor's responsibility to maintain a uniform consistent stone base gradation during the installation process. This shall include but not limited to keeping aggregate base at optimum moisture content (5%, \pm 1%) and/ or providing, placing, and compacting a ½ " layer of stone chips.
- G. Installation shall be accomplished using automated laser grade control, equipment, with dual-slope capabilities.
- H. Prior to calling for grade verification from Landscape Architect, the contractor shall have a registered land surveyor establish and set PK nails at the following locations:
 - 1. Back of end zone.
 - 2. Goal line.
 - 3. Every 5 yard line.
 - 4. Football side line
 - 5. Soccer touch line
- I. PK nails, or equivalent, shall be placed on turf nailer system. Do not set flush into nailer. Allow enough to loop grade line onto nail for grade verification. String Check.
- J. Contractor shall have on-site, prior to Landscape Architect arrival, the following equipment:
 - 1. One (1) ton steel drum rover – rubber tired equipment not acceptable.
 - 2. 50 ton 3/8" stone chips.
 - 3. Topdresser – to distribute 3/8" stone chips.
 - 4. Two (2) 48"/38" aluminum landscape rakes.
 - 5. 24" wide broom.
 - 6. There must be enough personnel to operate all equipment simultaneously.
- K. It will be the contractor's obligation and responsibility to have all of the above items in place prior to grade verification by Landscape Architect.

3.3 COMPACTION REQUIREMENTS

- A. Sub-grade shall be compacted to not less than ninety-two percent (92%) of maximum density at not less than seventy-five percent (75%) of optimum moisture content.
- B. Aggregate base course shall be compacted to not less than eighty-five percent (85%) of maximum density. Using conventional rolling equipment, moisture content shall not be less than ninety percent (90%) nor more than one hundred-ten percent (110%) of optimum moisture content. Using vibrating equipment, moisture content shall not be less than seventy-five (75%) of optimum moisture content.
- C. Maximum density shall be determined in accordance with AASHTO Modified Method of Test for the Compaction and Density of Soil, Designation T-180, and the optimum moisture content shall be that corresponding to the maximum density in the above test.
- D. Contractor shall maintain optimum moisture content during the installation, (placement, grading, compacting, etc.) of the aggregate base materials.

3.4 ROLLERS

- A. Smooth steel-wheeled rollers shall be self-propelled and have a total weight not less than 8 tons. The compression (driving) roller shall exert a pressure of not less than 250 lbs. per inch width of the roller.

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- B. Pneumatic-tire rollers shall have a compacting width of sixty (60) inches (1.5m) or more and shall be capable of varying the weight from 100 to 250 lbs. per inch of rolling width.

END OF SECTION 32 1123

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AGGREGATE BASE COURSE**PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.

1.2 SCOPE

- A. The work under this section of the specification shall consist of furnishing all labor, materials and equipment to produce, place, spread, compact and finish to proper grade and cross section all aggregate base courses according to the drawings and specifications.

1.3 SUBMITTALS

- A. Submit to the Landscape Architect a sieve analysis of the proposed stone to be installed.

PART 2 - PRODUCTS**2.1 MATERIALS:**

- A. Aggregate base material shall conform to DOT specifications for 21AA 100% crushed limestone and shall be placed and compacted to the minimum depth shown on plans. Crushed concrete, slag, etc. shall not be allowed.

<u>Aggregate Sieve Analysis</u>	<u>Percent Passing</u>
1½"	100
1"	85-100
½"	50-75
No. 8	20-45
No. 200	4-8

PART 3 - EXECUTION**3.1 SUB-GRADE CONSTRUCTION:**

- A. The sub-grade shall be so constructed as to have uniform stability for a width at least equal to that of the proposed pavement plus one (1) foot on each side. It shall be brought to an elevation and cross section such that, after being rolled, the surface will be at the required elevation. At the time the sub-grade is prepared, the fill area shall have been constructed to the full width and to at least the elevation of the finished sub-grade.
- B. The material present in the next six (6) inches below the elevation of the sub-grade shall be scarified, mixed and re-compacted, or otherwise treated to produce a uniform condition. Stones over four (4) inches in size shall be removed from the loosened portion of the sub-grade and disposed as directed by the project representative.

- C. Depressions that develop during the following shall be filled with suitable material, and the rolling shall continue until the sub-grade is uniformly firm, properly shaped and substantially true to grade and cross section. It shall be so maintained until the pavement is place.
- D. Material, other than sand, which will not compact readily under roller shall be removed and replaced with material which will compact readily and that portion of the sub-grade shall be rolled again.
- E. The rolling of the sub-grade shall extend for at least twelve (12) inches outside of each edge of the proposed turf boundaries when possible. Piles or ridges of earth or material that would seriously interfere with the operations of finishing the pavement shall not be left on the shoulders.
- F. During the process of construction sub-grade, the soil shall be maintained in a condition sufficiently moist to facilitate compaction and produce a firm, compact surface.
- G. If, in the preparation of the sub-grade, it becomes necessary to excavate below the elevation of the earth shoulders, ditches or drains shall be provided at frequent intervals to permit ready drainage of surface water from sub-grade to side ditches.
- H. If ruts or other objectionable irregularities form in the sub-grade during construction, the Contractor shall reshape and re-roll the sub-grade before the pavement is laid. The material used for filling ruts or other depressions shall be of such character as to make it equally desirable for sub-grade purposes as the material presented in the sub-grade.
- I. When the sub-grade is being prepared for placement as an aggregate base course, the elevation of the most finished surface, at the time the next layer is placed, shall not vary by more than 0.05 foot above or below the prescribed elevation at any point where measurement is made.

3.2 AGGREGATE BASE COURSE:

- A. Base course construction shall proceed as follows only after the Landscape Architect has approved the sub-grade construction and the gravel tests.
- B. The base shall be constructed in layers of not more than three (3) inches (75mm) compacted thickness when conventional rolling equipment is used.
- C. If vibratory or other approved special equipment is used, the thickness of every compacted layer may be increased to a maximum of eight (8) inches (150mm).
- D. The finished surface of any aggregate base course shall not vary more than 0.02 foot (15mm) from the elevations, grades and cross sections on the drawings.
- E. Compacted stone base dimensions shall be a minimum of 6".

3.3 COMPACTION REQUIREMENTS:

- A. Sub-grade shall be compacted to not less than ninety-two percent (92%) of maximum density at not less than seventy-five percent (75%) of optimum moisture content.
- B. Aggregate base course shall be compacted to not less than ninety-five percent (95%) of maximum density. Using conventional rolling equipment, moisture content shall not be less than ninety percent (90%) nor more than one hundred-ten percent (110%) of optimum moisture content. Using vibrating equipment, moisture content shall not be less than seventy-five (75%) of optimum moisture content.

- C. Maximum density shall be determined in accordance with AASHTO Modified Method of Test for the Compaction and Density of Soil, Designation T-180, and the optimum moisture content shall be that corresponding to the maximum density in the above test.

3.4 ROLLERS:

- A. Smooth steel-wheeled rollers shall be self-propelled and have a total weight not less than 8 tons. The compression (driving) roller shall exert a pressure of not less than 250 lbs. per inch width of the roller.
- B. Pneumatic-tire rollers shall have a compacting width of sixty (60) inches (1.5m) or more and shall be capable of varying the weight from 100 to 250 lbs. per inch of rolling width.

END OF SECTION 32 1124

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PLANT MIX BITUMINOUS ASPHALT PAVEMENT - TRACK

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.
- B. Related Sections:
 - 1. Section 32 1124 Aggregate Base Course

1.2 SCOPE

- A. The work under this section of specifications shall include the furnishing of all labor, materials and equipment necessary to produce, place, spread, compact and finish to proper grade and cross section all plant mix bituminous pavement as shown on the drawings and as specified herein.

1.3 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. Michigan Department of Transportation
 - a. All work done under this section of the specifications except as amended herein, shall be in accordance with current edition of the Michigan Department of Transportation Standard Specifications for Highway Construction, referred to hereafter as the MDOT Specifications.
 - 2. American Sports Builders Association (ASBA)
 - 3. National Federation of State High School Association (NFSHSA)
- B. Acceptability of the Work:
 - 1. Grade: Grade conformance tests shall be conducted on both the leveling and wearing courses. The entire surface shall have positive drainage, 1% lateral inclination and 0.1% in running direction.
 - 2. Planarity: After completion of the finish rolling operations on each course, the compacted surface shall be tested with a 10' straightedge. Measurements shall be made perpendicular to and across all mats at a distance not to exceed 25 feet. The maximum allowable planarity deviation within a pass shall be no more than 1/8" in 10' when measured in any direction.

1.4 SUBMITTALS

- A. Contractor shall submit mix designs for approval prior to placement which includes the exact proportions of bituminous material and mineral filler.

PART 2 - PRODUCTS

2.1 PLANT MIX

- A. Leveling Course: The bituminous plant mix base course shall meet the requirements of MDOT Specification 7.10 - Plant Mix Bituminous Mixtures. The specific mix and cross sections are as follows.

1. Thickness: Not less than 1 ½" inches when compacted
2. Liquid Asphalt or Bitumen: 5% ~ 7% by weight
3. Asphalt Penetration or Type: (PG-58-28)
4. Aggregate Type: Crushed limestone or natural aggregate. Slag is unacceptable.
5. R.A.P. not exceed 10%
6. MDOT Mix: 1100 L - 20AA

Aggregate Sieve AnalysisPercent Passing

¾"	100
½"	90-100
⅜"	65-95
No. 8	45-70
No. 30	20-45
No. 200	3-10

- B. Wearing Course: The bituminous plant mix base course shall meet the requirements of MDOT Specification 7.10 - Plant Mix Bituminous Mixtures. The specific mix and cross sections are as follows.

7. Thickness: Not less than 1 ½" inches when compacted
8. Liquid Asphalt/Bitumen: 5% ~ 9% by weight ($\pm 1\frac{1}{2}\%$)
9. Asphalt Penetration or Type: (PG-58-28)
10. Aggregate Type: Crushed limestone or natural aggregate. Slag is unacceptable.
11. R.A.P. not exceed 10%
12. MDOT Mix: 1100 T - 36-A

Aggregate Screen SizePercent Passing

½"	100
⅜"	92-100
No. 4	65-90
No. 8	55-75
No. 30	20-50
No. 200	4-10
Percent Crushed	60

PART 3 - EXECUTION**3.1 LIMITATIONS OF OPERATIONS**

- A. Bituminous tack coat shall be applied only when surface and weather conditions are favorable.
- B. Bituminous plant mix shall be placed only during daylight hours when the temperature of a shaded portion of aggregate the base is 40°F. or higher and when the surface upon which it is to be constructed is dry.

3.2 SUB-GRADE AND BASE COURSE PREPARATION

- A. Prepare sub-grade and aggregate base course in accordance with these specifications. The subgrade shall be proof compacted loaded rubber tired equipment and witnessed by a

representative of the design team. Areas that exhibit significant deflection or pumping shall be removed and replaced with compacted granular material. Aggregate base course shall be compacted to 95% of the maximum dry density as determined by ASTM D698 (AASHTO T99) procedures.

- B. At the time of applying bituminous material, the sub-grade surface shall be dry and clean, and all necessary repairs or reconditioning work shall have been completed.
- C. All objectionable foreign matter dirt, debris, etc. on the asphalt surface shall be removed and disposed by the Contractor.

3.3 BITUMINOUS TACK COAT

- A. Bituminous tack coat shall be applied at a rate of 0.10 gallons per square yard to existing bituminous surfaces and to successive plant mix surfaces. The tack coat may be waived by the Landscape Architect where successive plant mix courses are to be placed during one day's operation.
- B. The bituminous tack coat shall be applied uniformly to the clean, dry surface with a pressure distributor. Pools of bituminous material shall not be allowed to remain on the surface. The tack coat material shall be applied far enough ahead of the paving operation to allow it to cure before placing the subsequent plant mix bituminous material.

3.4 TEMPERATURE

- A. The temperature of bituminous material at the time of application shall be as approved by the Landscape Architect within the limits specified below.

SS-1h	105-180 degrees F.
Plant Mix	270-330 degrees F.

- B. The Landscape Architect may reject any load of plant mix bituminous material whose temperature is outside the temperature limits identified in 3.4A

3.5 PLACEMENT AND COMPACTION

- A. Paving operations shall provide a mat that is smooth, dense and of the proper thickness, slope and planarity. The plant mix bituminous material shall be compacted to 95% of the bulk density as determined by 50 blows-per -side Marshall procedures.
- B. The wearing course shall be placed such that the longitudinal joints of the wearing course are offset from that of the leveling course. Transverse joints shall be off set a minimum of 24".
- C. In placing each succeeding pass after the initial one, the screed of the paver should be set so that it overlaps the preceding pass by 2" and be sufficiently high so that when compacted, a smooth joint is produced. Prior to pinching the joint, the excess material shall be pushed onto the edge of the new pass with a lute. Excess material shall be removed from the pass.
- D. Deficient areas within the base course shall be corrected by sawcutting or milling to a depth equal to the thickness of the mat. Tack coat shall be applied to all edges and the pavement shall be replaced. Skin patching of the wearing course shall only be done with materials acceptable to the surfacing contractor.

3.6 BITUMINOUS PAVING

- A. After completion and acceptance of the stone base course, install 1½" of leveling course and 1½" of wearing asphalt materials.
- B. Installation shall be in two (2) separate courses of 1½" and 1½" after compaction. Each asphalt lift shall be installed using automated laser grade control, self-propelled paving equipment, with dual-slope capabilities.
- C. Edge Shaping: While surface is being compacted and finished, trim edges of pavement for proper alignment, bevel edges of asphalt and compact thoroughly.
- D. The plant mix bituminous material shall be compacted to 95% of the bulk density as determined by 50 blows-per-side Marshall procedures.
- E. Plant mix shall be placed and compacted in accordance with 1990 MDOT Specification Section 4.00 - Plant Mix Bituminous Pavements. The initial contact with the hot mixture leveling course shall be made by the power or driving roll of the steel roller, weighing not less than six (6) tons. The finish surface of the leveling course shall not vary more than 1/4" in 10 feet when measured in any direction. The finish surface of the wearing course shall not vary more than 1/8" in 10 feet when measured in any direction.

3.7 TESTS AND SAMPLES

- A. At the direction of the Landscape Architect, the Contractor shall cut samples from any course or finished pavement not to exceed five (5) in number from any days run for tests of density and composition. These samples shall be taken at points designated by the Landscape Architect by sawing with a power driven masonry saw or diamond core drill. Samples shall be sufficiently large to meet the needs of the testing laboratory.
- B. The Owner will hire an independent testing laboratory to perform field density testing with a nuclear density gage to verify that the specified density requirements are being met.
- C. The surface from which samples are taken shall be restored by the Contractor not later than the next succeeding day of plant operation.
- D. All test results will be available to the Contractor.
- E. All testing samples will be paid for in accordance with these specifications.
- F. Asphalt paving contractor shall power-wash asphalt prior to installation of tennis court or all weather track surface. Contractor shall flood the asphalt to identify all potential "Bird Bath" areas prior to surface application. Bird bath areas will be repaired as directed by the Landscape Architect.

END OF SECTION 32 1217

TRACK MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.
- B. Verify all-weather surface dimensions on plans, details, and field prior to track surface installation.

1.2 SCOPE

- A. The work under this section of the specifications shall consist of furnishing all labor, materials, equipment, transportation, and services necessary to complete the striping of track and field event markings.
- B. The track shall be marked for 8-42" lanes and include all event markings as recommended by National Federation of State High School Athletic Association and the Michigan High School Athletic Association.

1.3 SUBMITTALS

- A. Submit to the Landscape Architect upon notification of award of project, a drawing showing location of all proposed track markings and a chart with the appropriate colors to be used.
- B. Submit product literature for paint for prior approval from Landscape Architect. The paint must be recommended by the manufacturer of track surface.
- C. Upon completion, supply the Owner with all necessary as-built drawings showing color coded markings of each event.
- D. Upon completion, a letter of certification attesting to the accuracy of the markings shall be submitted by the Professional Engineer or Land Surveyor in charge of the layout. The letter shall be signed and sealed by the person or persons in charge of the layout indicating the state of registration, number and name.

1.4 ADDITIONAL MARKINGS:

- A. The following Junior High School Events will also be installed:
 - 1. 55 Meter Hurdles
 - 2. 200 Meter Hurdles
 - 3. 70 Meter Dash

PART 2 - PRODUCTS

2.1 PAINT

- A. Paint shall be that material as recommended by the manufacturer of the track surface.
- B. No thinners shall be used.

PART 3 - EXECUTION

3.1 COMPUTATIONS

- A. Verify the locations of proposed events with the Owner.
- B. Calculations shall be made to the nearest 1/100,000th of a foot.
- C. Calculations of the angle shall be made to the nearest one second.
- D. Calculations shall be submitted to the Landscape Architect prior to the painting.
- E. Calculations shall be made by or certified by the engineer or surveyor completing the work.
- F. All measurements and tolerances shall conform with those recommended by the N.F.S.H.S.A. for track and field event layout.

3.2 LAYOUT

- A. Lines and markings shall be made by a competent, experienced and fully qualified Professional Engineer or Registered Land Surveyor.
 - 1. Locate and confirm both new radius points.
 - 2. Establish and set all necessary control points.
 - 3. Measurements shall be made on the track to the nearest 1/100th of a foot.
 - 4. Angles shall be set by using a transit or theodolite capable of reading direct to 20 seconds.
 - 5. The markings on the curve may also be set by using the chord length method.
 - 6. Measurements shall be made with an engineering steel tape in engineering scale.
 - 7. All markings shall be clearly identified and color coded for the painter to identify.

3.3 TRACK MARKINGS

- A. All markings shall conform with those recommended by the N.F.S.H.S.A. for track and field event layout.
 - 1. Lanes and lines shall be 2" wide markings with color determined by Owner..
 - 2. Start and finish lines shall be 2" wide lines and shall be clearly marked with the start of said events.
 - 3. Exchange zones shall be indicated with triangles with a 41" base and 24" high with the base as the limits of the zone.
 - 4. Acceleration marks shall be a 2" wide by 4" long dash marked clearly in the center of the lane.
 - 5. Hurdle marks shall be 2" x 2" tic marks on the lane line on both sides of the lane.
 - 6. Lane numbers shall be not less than 42" high and located as directed by the Landscape Architect in four (4) locations. Numbers shall be in two (2) colors (shadowed background as selected by the Owner).
 - 7. Event identification shall be 4" letters stenciled below and to the right of each lane and mark.
 - 8. Scratch lines for the jumping events shall be 8" wide.
 - 9. All symbols shall have the proper color code for the event.
 - 10. Check marks for the long jump and pole vault events shall be included with bid. Coordinate frequency and locations with athletic department prior to striping.
 - 11. Discus pad and shot put pad dimension boundaries shall be a 2" painted circle. See details for proper dimensions.

3.4 INSTALLATION

- A. No painting shall be performed when the velocity of the wind exceeds twelve miles per hour (12mph), unless the spray equipment is equipped with the proper air curtains.

****Contact the Athletic Department and verify all markings prior to installation.****

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BLACK SURFACE

All Lanes

Yellow-White Alleys

Common Finish

White

Common Exchange Zone

Green

EVENT	GRAPHIC SYMBOL	COLOR
70 M DASH	Start Line	White
100 M DASH	Start Line	White
200 M DASH	Start Line (1 turn stagger)	White
400 M DASH	Start Line (2 turn stagger)	White
800 M RUN	Alleys	Green
1600 M RUN	Alley Start	White
3200 M RUN	Alley Start	White
100 M HIGH HURDLES	Start Line Hurdle Location	White Yellow
110 M HIGH HURDLES	Start Line Hurdle location	White Blue
300 M INT/LOW HURDLES	Start Line Hurdle Location	White Red
400 M RELAY 4 x 100	Start Line Exchange Zone	White Yellow △
800 M RELAY 4 x 200	Start Line 1st-exchange zone 2nd-exchange zone 3rd-exchange zone	White Red △ Red △ Yellow △
1600 M RELAY 4 x 400	Start Line 1st-exchange zone 2nd-exchange zone 3rd-exchange zone	White Blue △ Blue △ Blue or Blue/Green Split △
3200 M RELAY 4 x 800	Waterfall Start Common Exchange Zone	White Blue or Blue/Green Split △
55 M LOW HURDLES (Junior High Event)	Start Line Hurdle Location	White Yellow
200 M INT/LOW HURDLES (Junior High Event)	Start Line Hurdle Location	White Red
LANE NUMBERS	Primary Number Shadow	White To Be Selected

END OF SECTION 32 1724

SYNTHETIC TURF – PARALLEL SLIT SAND/RUBBER

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents, including General and Supplementary Conditions. Drawings shall be coordinated with the applicable provisions of the other parts.
- B. Related Sections:
 - 1. Section 32 1123 Aggregate Drainage Layer

1.2 SCOPE OF WORK

- A. The work under this section shall consist of furnishing all labor, materials and equipment, necessary to install, in place, all synthetic turf materials as indicated on the plans and as specified herein. The installation of all new materials shall be performed in strict accordance with these specifications, the manufacturer's instructions and in accordance with all details and shop drawings. The scope of work shall include the following:
 - 1. Provide and install a parallel slit polyethylene turf carpet, infill system shall be recyclable SBR rubber and silica sand. Infill to be provided by the turf manufacturer, along with additional components including inlaid game lines, markings and logos as indicated, for a complete system.
 - 2. Inlaid football inbound lines, individual yardline markings, restraining line, field numbers, football kick-off, soccer lines, centerfield logo and endzone graphics, practice hash marks.
 - 3. Maintenance Equipment
 - 4. Manufacturer's Warranty – Guarantee (8 Years)
 - 5. 3rd Party Insured Warranty
 - 6. Manufacturer/Installer shall provide +/- 2000 lbs of additional rubber infill material to the Owner.
 - 7. Manufacturer/Installer shall provide +/- 200 sf of each color of the synthetic turf installed.
 - 8. Manufacturer/Installer shall provide +/- 100 lf of each 4" line color of the synthetic turf installed.

1.3 QUALITY ASSURANCE AND REFERENCE STANDARDS

- A. Bidders shall submit a color roll of standard manufacturer colors with their bid.
- B. Turf System Provider (Builder/Installer) must be experienced in the installation of fifty (50) fields of the synthetic turf system being proposed in the last (5) five years with the same manufacturer, product and infill proposed for this project. This includes the fiber, backing, the secondary backing and installation method. Product shall meet the following criteria:
 - 1. Have a NCAA Division 1 football field installed with parallel slit or monofilament fiber product.
 - 2. Have a football field of 85,000 sq. ft. or more of the exact specified material, including the infill material and fiber, in play for at least two years with the same turf manufacturer and company they are proposing for this field.
 - 3. Must have five fields in play for the past year, utilizing the same fiber and fiber manufacturer that is being proposed for this field.
 - 4. Verification that provider meets these requirements shall be included with Bid.
- C. Builder/Installer Experience:

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1. Must be a member in good standing of the Synthetic Turf Council (STC) and/or American Sports Builders Association (ASBA). Provider shall employ one ASBA Synthetic Turf Certified Turf Builder.
 2. Installation team shall be established and experienced in the field with a minimum of 5 years experience with 15 foot wide materials.
 3. On-Site superintendent shall have at least 10 installations for at least five years of synthetic turf system specified.
- D. PRE-BID TESTING: Turf System Provider shall submit test results from that are not older than one year, from an independent lab certifying their product meets or exceeds the following test requirements. Provider shall furnish test results to Landscape Architect for approval prior to bidding.
1. Player/Surface Interaction Characteristics:

PROPERTY	TEST METHOD	REQUIREMENT	LAB AND FIELD TEST
Shock Absorption	ASTM F1936	≤165 G's	Lab / Field
Force Reduction	ASTM F2157-02	55% - 70%	Lab / Field
Vertical Deformation	ASTM F2157-02	4 - 9 mm	Lab / Field
Rotational Resistance	EN 15301 Method 1	25 Nm – 50 Nm	Lab / Field

2. Ball/Surface Interaction Characteristics:

PROPERTY	TEST METHOD	REQUIREMENT	LAB AND FIELD TEST
Vertical Ball Rebound	ASTM F2117	30% - ≤ 50%	Lab / Field
Ball Roll	EN 12234	≤10m	Lab / Field

E. PRE-SHIPMENT TESTING

1. Prior to delivery of materials to site, Turf Provider shall submit the test results, from an independent lab, of (5) random rolls manufactured for this project. These test results must be sent and approved prior to product shipping to site. Any test result not meeting specification minimums is grounds for rejection of entire product.
 - a. Test sample shall be from five random rolls manufactured for this project. Proof of documentation must be provided upon delivery of the carpet to the job site.
 - b. Test results shall identify manufacturer, date of test(s), lab technician, project, lot number, etc.
 - c. Testing based on the following physical characteristic data:

Test Property	ASTM Test
Denier	ASTM D418
Pile Ribbon Wt	ASTM D5848
Primary Backing Wt	ASTM D5848
Secondary Backing Wt.	ASTM D5848
Tuft Bind	ASTM D1335
Yarn Elongation	ASTM D2265
Grab Tear Strength	ASTM D5034
Flammability	ASTM D2859
Lead Content	ASTM F2765

F. POST-INSTALLATION TESTING:

- Following installation, the turf field shall be tested by an independent lab certifying product specified meets or exceeds the following test requirements. Installer and Owner shall be furnished test results and installer shall be required to make adjustments to comply with specified values noted below. Test site locations for shock absorption shall be as noted in ASTM F1936. The test procedure will be ASTM 1936, Procedure A.

PROPERTY	TEST METHOD	REQUIREMENT	LAB AND FIELD TEST
Shock Absorption	ASTM F1936	≤110 G's	Lab / Field

- Following installation and acceptance by the Owner, the turf field may be tested by an independent lab certifying product specified meets or exceeds the following test requirements. Installer shall be furnished test results if requested, be required to make adjustments to comply with specified values noted below. Testing shall be coordinated by and paid for by the Owner.

- Player/Surface Interaction Characteristics:

PROPERTY	TEST METHOD	REQUIREMENT	LAB AND FIELD TEST
Shock Absorption	ASTM F1936	≤165 G's	Lab / Field
Force Reduction	ASTM F2157-02	55% - 70%	Lab / Field
Vertical Deformation	ASTM F2157-02	4 - 9 mm	Lab / Field
Rotational Resistance	EN 15301 Method 1	25 Nm – 50 Nm	Lab / Field

- Ball/Surface Interaction Characteristics:

PROPERTY	TEST METHOD	REQUIREMENT	LAB AND FIELD TEST
Vertical Ball Rebound	ASTM F2117	30% - ≤ 50%	Lab / Field
Ball Roll	EN 12234	≤10m	Lab / Field

G. REFERENCE STANDARDS:

- American Society for Testing and Materials (ASTM):

F1551-03 -	Standard Test Method for Comprehensive Characteristics of Synthetic Turf Playing Surfaces and Materials
D5848-98 -	Standard Test Method for Mass Per Unit Area of Pile Yarn Floor Covering
D418 -	Standard Test Method for Testing Pile Yarn Floor Covering Construction (Withdrawn)
D1335 -	Standard Test Method for Bind of Pile Yarn Floor Coverings
D638-03 -	Standard Method of Test for Textile Properties of Plastics
D5034 -	Standard Test Method of Breaking Strength and Elongation of Textile Fabrics (Grab Test)
F1015-03 -	Standard Test Method for Relative Abrasiveness of Synthetic Turf Playing Surfaces
D2256-02	Standard Test Method for Tensile Properties of Yarns by the Single Strand Method
D2157-02	Standard Specification for Synthetic Surface Running Tracks

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F2117	Standard Test Method for Vertical Rebound Characteristics of Sports Surfaces/Ball Systems; Acoustical Measurement
D4491 -	Standard Test Methods for Water Permeability of Geotextiles by Permittivity
D2859-04 -	Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials
F355 -	Standard Test Method for Shock-Absorbing Properties of Playing Surfaces.
F1936-	Standard Test Method for Shock-Absorbing Properties of North American Football Field Playing Systems as Measured in the Field
D1557 -	Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
F2765 -	Standard Test Method for Total Lead Content in Synthetic Turf Fibers

2. National Collegiate Athletic Association (NCAA)
3. National Federation of State High School Associations (NFHS)

- H. RESUMES: Upon request, Bidder shall submit resumes detailing level of experience of each installation foreman or supervisor.
- I. MANUFACTURER'S INSTRUCTIONS: Comply with the manufacturer's applicable instructions and recommendations for installation to whatever extent these are more stringent or explicit than indicated in the contract documents.
- J. MATERIALS: All supplied and installed materials and products will meet or exceed the minimum specifications designated in this section. The synthetic turf colors specified and detailed shall be standard manufacturer colors, unless otherwise noted. Contractor shall submit test results, from an independent lab of 5 random rolls of carpet intended for this project, before shipping to the site.
- K. INSPECTION: Inspect delivered field surface fabric components immediately prior to installation. Any damaged or defective items shall be rejected. Installed artificial system shall be inspected for, but not limited to the following: acceptable seams, glue bonding, uniformity of product and color, surface bubbles, field markings, and field edge installation. The pile height of each roll supplied fabric shall be measured. Any material(s) that does not meet minimum height and thickness specifications shall be rejected. Pile height shall be measured in its finished position. Manufacturer shall provide evidence of random samplings obtained during the manufacturing process that the carpet meets or exceeds the specifications below.
- L. BASE ACCEPTANCE: The synthetic turf manufacturer and/or installation contractor shall perform an inspection of the field base onto which the synthetic turf system is to be installed and to examine the finished surface for required compaction, permeability and grade tolerances. The turf installer will accept the aggregate stone base in writing when the Owner's representative provides test results for compaction, permeability and planarity that are in compliance with the project plans and specifications. After any discrepancies between the required materials, application and tolerance requirements noted have been corrected, the synthetic turf installer should submit a written certification of acceptance of the base for installation of subsequent layers of the synthetic turf system. The acceptance of the base construction should be included in the certification for warranty validation.
- M. FIELD DIMENSIONS: Turf Provider is responsible for verifying field size and layout of markings and dimensions to verify conformity to specifications and governing standards.

N. WARRANTY SAMPLES: Submit 3 "sample copies" of the PROPOSED WARRANTY" to be provided at the completion of the Contract. Warranty period shall be for not less than eight (8) years after final acceptance and incorporate all components. Warranty shall be provided by system installer who shall be responsible for carpet, inlays and infill. Maintenance is an essential element in the performance and life cycle of each system. The maintenance procedures and equipment as specified by the manufacturer and required for the system shall be evaluated during the selection process so that the appropriate budget resources (manpower & equipment) may be allocated.

1. All turf warranties shall be full, non-prorated, limited to repair or replacement of the affected areas, at the option of the Manufacturer, and shall include all necessary materials, labor, transportation costs, etc. to complete said repairs. All warranties are contingent on the full payment by the Owner of all pertinent invoices.

2. The artificial grass field turf must maintain an ASTM 1936 G-max between **85-165** for the life of the Warranty.

* Warranties for the synthetic turf field systems shall address the following:

- Acceptable uses for the field
- Fading
- Color match within specifications
- Excessive fiber wear
- Wrinkling and panel movement
- Shock absorbency (G-max)
- Seam Integrity
- Drainage (of Carpet and Infill only)
- Flammability
- Response time for required repairs/replacement

3. Results of G-max shall not deviate by more than 10%. See chart below.

<u>Football Field</u>	<u>6 pts</u>
Average Initial G-max (w/o Pad)	100-110

4. Contractor shall provide an independent 3rd party insurance policy to cover items identified above.

5. Infill shall be evaluated and accepted during initial installation. Contractor shall provide shipping receipts verifying specified rubber quantity was delivered. If the field lacks sufficient material to properly support P.E. fiber, contractor shall provide and install additional rubber as needed at no additional cost to the owner. Contractor shall inspect the field after 1 year to provide and install sufficient amount of rubber to support all except ½" of the turf fiber.

O. FINAL ACCEPTANCE:

1. At the completion of the project, Contractor shall provide the following:

- a. Certificate of Substantial Completion.
- b. Certification of Owner Attic Stock Materials.
- c. Warranty: Submit warranty and ensure forms have been completed in Owner's name and registered with Manufacturer.
- d. 5 complete sets of Maintenance Manuals, which will include necessary instructions for the proper care and preventative maintenance of the synthetic turf system, including line/marking installation and removal, small repair procedures and cleaning.
- e. List of procedures required to maintain surface condition and activities to be avoided in order to prolong the life and maintain the warranty, including static and dynamic load limits,

snow clearing, etc.

- f. Project Record Documents: Record actual locations of seams or other pertinent information that is different from approved shop drawings.
2. Within twelve months after initial installation, Turf Provider may be required to return to supplement rubber and perform maintenance.
3. Installer shall provide training session for Owner and their selected representatives.

1.4 SUBMITTALS

A. All submittals shall be provided within 14 days after Notice to Proceed.

1. Shop Drawings - Submit complete and detailed shop drawings including layout of all components, parts and materials installed under this section. Shop drawings shall show proposed locations of all seams in fabric surfacing. Custom logos can be provided in AutoCad 2000 format to expedite shop drawing process.
2. (4) 1'x1' samples of turf proposed for project.
3. (4) samples of inlaid or tufted colors proposed for project.
4. Field Lining and Marking - Submit a complete scale and dimensional drawing of inlaid or tufted in field linings and marking boundaries.
5. Fiber manufacturer's name, type of fiber and composition of fiber.
6. Rubber, with certification of availability, from supplier guaranteeing product supply reserved for the Melvindale – Northern Allen Park Public Schools.
7. The Turf Contractor and the Turf Manufacturer (if different from the company) shall provide a sample copy of warranty and insurance policy information with Bid Proposal Form.
8. Maintenance Equipment submittals, including product data, operational instruction, etc.

B. MAINTENANCE EQUIPMENT

1. The Turf Contractor/Manufacturer shall supply, as part of the Base bid the following equipment to each site. Contractor shall provide one (1) Groomer and one (1) Sweeper for routinely brushing the field to be a single unit of putting green quality.
 - a. Groomer/Sweeper combined unit shall be:
 - i. "Turfcare TCA1400" by SMG (attn: Kevin Dorney), Renton, WA (425) 687-1560

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The turf system shall consist of an artificial grass-like surface pile, which shall be tufted into a primary backing and coated with a secondary backing to lock in the tufted fibers.
- B. The entire system shall be resistant to weather, insects, rot, mildew, and fungus growth, and will be non-allergic and non-toxic.
- C. The entire system shall be constructed for porous standards as specified.
- D. The pile surface shall provide good traction in all types of weather with the use of conventional sneakers type shoes, composition mold sole athletic shoes, baseball spikes, and screw-on football cleats.
- E. In addition to the tufted lines, inlaid lines and logos, the pile surface shall be suitable for both temporary and permanent line markings using paint specifically developed for this use and as recommended by

the turf manufacturer.

- F. The fabric surface will be installed in 15 foot width (recommended).
- G. All synthetic turf seams shall be sewn with a double-lock stitch.
- H. The dynamic cushioning of combined turf and infill material supplied shall not exceed an average maximum value of 110 G's, at 70°F upon initial installation, utilizing ASTM Test F-1936-95, not to exceed 165 G's over warranty period.
- I. The entire system will be constructed to maximize dimensional stability, to resist damage, resistant to ultraviolet radiation, and sustain normal wear and tear for its designated uses.
- J. All adhesives used in bonding the inlaid markings to the adjacent carpet shall be resistant to moisture, bacteria and fungus attacks, and resistant to ultraviolet radiation.
- K. Rubber will either be ambient ground or cryogenic produced (supplier to submit verification) and be sized to allow a system infiltration of water at a rate of 10" per hour.

2.2 PRODUCTS

- A. The synthetic turf material and resilient infill shall be in accordance with the following:
 - 1. The fiber shall be an 8,000 denier, 100 micron thickness 100% polyethylene, low friction fiber, measuring not less than 2" inches high. The fiber shall be specifically designed to virtually eliminate abrasion.
 - 2. The fiber weight shall not be less than 44 ounces per square yard. The overall product weight must not be less than 76 ounces per square yard. The low friction non-abrasive fiber shall be 100% polyethylene, treated with a UV inhibitor.
 - 3. The primary backing shall consist of a one part, three component polyester/polypropylene backing with a minimum weight of 8 ounces per square yard. The secondary backing shall consist of an application of porous polyurethane (minimum of 24 ounces per square yard), heat activated to permanently lock fibers in place. Products using latex based secondary backings will not be acceptable. The synthetic grass system can be perforated with 1/4" holes every four (4") inches in both directions, or the secondary backing can be applied to the tufted fiber rows, to provide for maximum drainage. Complete synthetic grass system shall drain in excess of 10" per hour.
 - 4. The carpet shall be delivered in 15-foot wide rolls with the four 4 inch white, 5-yard lines tufted into each roll. The rolls shall be of sufficient length to go from sideline to sideline. The perimeter white line shall also be tufted into the individual sideline. Head seams between the sidelines of the football field will not be acceptable. The perimeter white line shall also be tufted into the individual sideline rolls.
 - 5. All field lines, numbers and markings indicated on plans can be permanently inlaid.
 - 6. The primary fiber color shall be alternating panels of Field Green and Field/Lime Blend (50/50), in color to simulate natural grass as closely as possible and treated with UV inhibitor, guaranteed a minimum of eight years.
 - 7. The rubber infill shall consist of a non-compacting mixture of uniformly sized ambient and/or cryogenic recycled SBR crumb rubber.
 - a. The Crumb Rubber Infill (CRI) material used shall be derived from whole, vulcanized highway vehicle tires manufactured in the United States.
 - b. No factory tires rejects are allowed.
 - c. The Crumb Rubber shall have a specific gravity range from 1.1 minimum to 1.2 maximum as determined by ASTM D 297.

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- d. The CRI used as infill shall conform to the following chemical analysis:

<u>TEST</u>	<u>ASTM TEST METHOD</u>	<u>MAX.</u>	<u>MIN.</u>
Acetone Extract	D 297	16.0%	-
Ash Content	D 297	4.0%	-
Rubber Hydrocarbon	D 297	55.0%	40%
SBR Content	D 297	-	75%

8. Rubber Mesh

a.

Sieve Size	*Mesh (ASTM E-11) Percent Retained
8	
12	1.3%
16	58.8%
20	38.2%
30	1.0%
40	0.0%
50	0.0%
PAN	Not-to-exceed 0.004%

- b. Provide a minimum 3.0 pounds per square foot

9. Synthetic Turf Physical Characteristics:

<u>Physical Properties:</u>	<u>Minimum Specification Requirements</u>
Pile Ht	2.0"
Pile Ribbon Wt	44 oz./sy
Primary Backing Wt	8 oz./sy
Secondary Backing Wt.	24 oz./sy
Total Face weight	76 oz/sy
Denier	8,000
Fiber Thickness	100 Micron
Primary Backing Material	Polypropylene
Secondary Backing	Polyurethane
Tuft Bind	8 lbs w/o infill
Fiber Composition	Polyethylene, Parallel-slit
Yarn Supplier	<ul style="list-style-type: none"> • Bonar Yarns & Fabrics • Tencate • Polytex (Duramax minimum) • Proprietary fiber shall be pre-approved by Architect
Yarn Elongation	50%
Grab Tear Strength - Width	300 lbs/force
Grab Tear Strength - Length	180 lbs/force
Flammability	Pass
Carpet Drainage	4" on-center, both ways or tufted fiber rows only

10. Silica Sand

- a. Round, uniformly-sized pure silica sand
- b. Sized between US Sieve 20 to 40
- b. Provide a minimum 3.0 pounds per square foot

PART 3 - EXECUTION

3.1 CERTIFICATION OF BASE CONSTRUCTION

- A. GENERAL: A written "Certification of Acceptance of the Base Construction" is required from the artificial turf/surfacing system prior to proceeding with any installation work under this section of the specifications.
- B. SCOPE: This certification shall include but not be limited to the acceptance of:
 1. The base construction finish surface is completely acceptable for the application of work specified under this section.
 2. The materials and method of installation for the aggregate stone base construction is in conformance with the manufacturer's current recommendations for the application of the turf to be installed under this section.
 3. The aggregate stone base construction is totally suitable for work to proceed with the assurance that the final installation of the work under this section will result in a high quality athletic sub-base. In order to provide these assurances and the Certificate of Acceptance, the turf system installer shall cooperate and communicate fully, at all times, with the construction manager. This contractor shall inspect the base construction work and verify that conditions and tolerances required for application of the artificial turf system are being met and that the Owner's representative has provided test results for compaction, porosity and planarity.
 4. All discrepancies between the required materials, application and tolerance requirements noted by the installer shall be brought immediately to the attention of the Contractor and Landscape Architect. Failure to immediately inform the contractor and Landscape Architect of any prior work which does not meet the required specifications for installation of the artificial turf surfacing system shall be considered an acceptance by the installer of the non-conforming work. Any additional work later required to bring the base to acceptable conditions shall be preformed by this installer at no additional cost to the Owner. Any discrepancies in the prior work which does not meet the specifications and noted in writing to the Owner and Landscape Architect shall be preformed immediately at no additional cost to the Owner.

3.2 INSTALLATION OF THE TURF

- A. GENERAL: All installation shall be done in strict accordance with the manufacturer's current printed installation instructions approved by the Landscape Architect.
- B. REPLACEMENT: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Landscape Architect and at no additional cost to the Owner.
- C. ENVIRONMENTAL CONDITIONS: Weather conditions are important for the successful installation of the systems. No work under this section will proceed when:
 1. Ambient air temperatures are below 40 degrees F.
 2. Material temperatures are below 40 degrees F.
 3. Surfaces are wet or damp
 4. Rain is imminent or falling

5. Conditions exist or are imminent, which will be unsuitable to installation requirements of the systems specified herein. Humidity levels will be inside the limits recommended by the adhesive manufacturer to obtain optimum bonding characteristics of the surfaces.

D. BONDING OF MATERIAL SURFACES

1. The adhesive bonding of all system material components shall provide a permanent, tight, secure and hazard free athletic playing surface.
2. The following components, at a minimum, shall meet the bonding requirements noted below:
 - a. Turf to turf sewn.
 - b. All turf terminal edges shall be stapled/nailed.
 - c. Turf inlays as indicated on drawings shall be cut and glued or shaved and hot melt.

- E. **WORK QUALITY:** The bonding design and work shall be such that all surface joint and seams shall remain as required above throughout the duration of the warranty period at a minimum.

F. SEAM SPACINGS

1. All seams widths are to be held to the absolute minimum and as approved.
2. All seams (butt joints) shall be traverse to the field direction; i.e. run across the field.
3. All lateral seams are to be sewn with a double-lock stitch.

- G. **EDGES:** Turf edges will be shown on details and specified herein.

1. The perimeter of the field shall be firmly secured to the edge anchors, for the life of the warranty and as detailed, using stainless steel or hot dipped galvanized fastener space \pm 18" oc. Anchor/nailer installed by others.

- H. **TURF SYSTEM DRAINAGE:** Turf system shall include, upon completion of turf, perforation of same for drainage. Method of porosity shall be reviewed prior to award of any contract. System shall provide a minimum rate of infiltration of 10" per hour.

3.3 FIELD LINING AND MARKINGS

- A. **GENERAL:** A complete field "Lining, Marking and Field Boundary" system will be provided with the installation of the surfacing system specified herein.
- B. **INLAYS:** Shave and hot-glue or cut and glue.
- C. **LAYOUT:** Striping layouts shall be accurately surveyed by the Contractor before installation of inlays.
- D. **WORKMANSHIP:** All seams shall be flat, tight, and permanent with no separation or fraying. Inlaid markings shall be adhered to a special tape or shaved and adhered to a two-part, high strength polyurethane adhesive applied per the Turf Manufacturer's standard procedures for

3.4 SITE TESTING

- A. Site testing shall be at ambient shaded air temperature of 40 - 100°F. Laboratory testing shall be at ambient indoor temperature unless otherwise specified by the test method. Unless otherwise specified, field test measurements shall be made at a minimum of 5 locations. Test locations shall conform as closely as possible to the test sites specified in ASTM F1936 (field used primarily for North American Football).

3.5 ENVIRONMENTAL CONDITIONS

- A. Weather conditions are important for the successful installation of the systems. No work should proceed when:
1. Conditions exist or are imminent, which will be unsuitable to installation requirements of the systems specified herein.
 2. Humidity levels will be inside the limits recommended by the adhesive manufacturer to obtain optimum bonding characteristics of the surfaces.
 3. Ambient air temperatures are below 50°F.
 4. Material temperatures are below 50°F.
 5. Surfaces are wet or damp.
 6. Rain is imminent or falling.

END OF SECTION 32 1815

SAMPLE SYNTHETIC TURF WARRANTY

1.1 Warranty

- A. System Installer/Manufacturer ("_____") hereby warrants to Melvindale – Northern Allen Park Public Schools subject to the limitations and conditions set forth below, that its entire synthetic turf installation described as _____, is free from defects in material workmanship, meets or exceeds the specifications, and shall **(for a period of EIGHT (8) YEARS from the date of final acceptance)** remain acceptable for multiple sports activities.
- B. System Installer/Manufacturer warrants to Melvindale – Northern Allen Park Public Schools that its synthetic turf system shall not unevenly fade, shall not fail, shrink, expand, flood, tear, bubble and shall not reflect unusual excessive wear and shall meet specified Gmax values, for a period of EIGHT (8) YEARS from the date of final acceptance. In the event that the synthetic turf shall unevenly fade, fail, shrink, expand, flood, tear, bubble or reflect excessive water, System Installer/Manufacturer shall replace such areas of the synthetic turf that are affected.
- C. System Installer/Manufacturer warrants to Melvindale – Northern Allen Park Public Schools that the installation of the entire synthetic turf and all associated turf components (i.e. Inlays and seams) shall be performed in a professional manner under the supervision of highly-trained employees familiar in the installation of their tufted synthetic turf system. The supervisor and key installers shall have installed synthetic turf systems for at least three (10) previous system installations.
- D. System Installer/Manufacturer warrants that the finished synthetic turf system shall have an initial G-max (shock attenuation) value of approximately 130 G's and shall not become harder than 165 G's over the life of the system at any point on the field of play. The manufacturer shall make only the necessary repairs if, at any time during the warranty period, the G-max force at any point exceeds the specified 165 G's.
- E. The term "not fade" in the context of the warranty shall mean that the synthetic turf shall remain uniformly true in color without unsightly or uneven change, except as affected by changes in texture resulting from normal wear and tear.
- F. The term "not fail" or "excessive wear" as used in the context of this warranty shall mean that the length and weight of the face yarn or pile material in the synthetic turf shall not have decreased by more than 2% per year (according to ASTM D-418) not to exceed 25% (averaged over the entire field) anytime during the EIGHT-YEAR warranty period. Any panels where face yarn has decreased more than 2% per year or more than 25% during the EIGHT-YEAR warranty period will be replaced.
- G. System Installer/Manufacturer shall warrant seams against separation, puncturing, bubbling, etc., for any reason.
- H. This warranty does not cover any defect, failure, damage or undue wear in or to the synthetic turf system caused by or connected with abuse, neglect, deliberate act, Act of God, casualty, static or dynamic loads exceeding recommended levels, footwear having metal cleats, spikes, or similar projections (other than conventional football, baseball, soccer or rugby shoes having cleats of not more than ½" in length).

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- I. System Installer/Manufacturer shall be allowed to examine the synthetic turf system regarding any claim which Melvindale – Northern Allen Park Public Schools makes, to be present at and to analyze the results of all tests conducted by Melvindale – Northern Allen Park Public Schools or others, and to conduct such tests incurred by Melvindale – Northern Allen Park Public Schools or others with respect to such tests.
- J. All claims made by Melvindale – Northern Allen Park Public Schools under this warranty must be made in writing to System Installer/Manufacturer.
- K. This warranty, when signed and notarized by all parties, shall constitute a contract made in the State of Michigan and shall be governed by the laws thereof.
- L. Contractor shall provide an independent 3rd party insurance policy to cover all items identified above.

OWNER: Melvindale – Northern Allen Park Public Schools

DATE: _____

BY: _____

CONTRACTOR:

DATE: _____

BY: _____

MANUFACTURER:

DATE: _____

BY: _____

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ALL-WEATHER SYNTHETIC TRACK SURFACE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.
- B. Related Sections:
 - 1. Section 32 1217 Plant Mix Bituminous Pavement

1.2 SCOPE OF WORK

- A. The work under this section of the specification shall consist of furnishing all labor, materials and equipment to produce, place, spread, and finish to proper grade and cross section, an all-weather synthetic track surface.

1.3 QUALITY ASSURANCE

- A. Reference Standards
 - 1. American Society for Testing and Materials (ASTM):
 - a. F 2157-02 Synthetic Surfaced Running Tracks
- B. Each Bidder shall submit color samples with their bid.**
- C. The manufacturer must have ten (10) uninterrupted years of experience compounding polyurethane for athletic surfacing under the same corporation name. The installer must have ten (10) years experience installing the specified system with the same polyurethane. This is applicable for the polyurethane alternates only.
- D. The synthetic track surface shall be installed by authorized applicators of the approved manufacturer, acceptable to the Owner. The Owner reserves the right to final acceptance with regards to any installers. The manufacturer must attest to the work previously completed by each person installing the work. The Installation Contractor shall be solely responsible for the following:
 - 1. Protection of the surface until it has fully cured.
 - 2. Removal of all excess rubber crumb and binder on the inside and outside edges.
 - 3. All material used shall be handled, shipped and installed as outlined in the Material Safety Data Sheets and according to current O.A.S.H.A. Standards.
 - 4. Disposal of all products as per current EPA Regulations.
 - 5. Inspection and acceptance of the asphalt surface, prior to manning the site.
 - 6. Verify all-weather surface dimensions on plans, details, and field prior to track surface installation.
 - 7. Submission of an affidavit acknowledging each crew member, to be assigned to this project has read the Material Safety Data Sheets and is familiar with all safety procedures and the proper handling of all materials.
 - 8. Submission of the Material Safety Data Sheets prior to the material arrival. Submission shall be in triplicate and the job superintendent shall maintain a copy on the site at all times.
- E. The work shall conform to standards for running track construction as prescribed or approved by the National Federation of State High School Associations (NFSHSA) *Track and Field Rule Book* and

American Sports Builders Association (ASBA) *Track Construction Manual*. Installer must be a member of the American Sports Builders Association (ASBA).

- F. Base Bid shall be Black and not be less than 13mm total thickness. This depth shall be measured from the top of asphalt to the top of the continuous surface. (ie. to the top of the binder, not to the top of the projecting rubber corners)

1.4 SUBMITTALS

- A. Each Bidder shall submit one (1) sample, not less than 3" X 3" with each surface being bid. All samples shall represent the exact surface being bid. These samples will be used to determine the most qualified surface.
- B. Each Bidder shall submit a complete installation specification with the bid and any items that are regarded as technical guidelines for the installation of the surface that varies from the specification, include maintenance instructions and recommendations.
- C. Each Bidder are required to submit a list of facilities that have been installed under this product name. List to include four (4) to five (5) year old surface installations with contact person, and telephone number.
- D. Contractor must submit copies, in triplicate, of the Material Data Safety Sheets (MSDS) for all products to be used, before materials are delivered to the site.

1.5 TESTING

- A. The Owner shall reserve the right to submit the surface to the following tests to determine the surface performance. Any section of the track that is found to be unacceptable by these standards shall be removed and replaced in a proper workmanship-like manner.
- B. The sample size shall be approximately one (1) square foot. The samples shall be taken for testing and not replaced. A sample shall be taken for every four thousand (4,000) square feet. If the surface is acceptable, the Owner will accept the responsibility of the testing cost and the replacement cost for surface areas.
- C. The above performance characteristics shall be a part of the overall performance of the surface. The data that shall be obtained from the above testing will be the factors that will determine the final acceptance of the surface if the above tests are required.
- D. The installation Contractor will be responsible for all tests that fail the above characteristics. The Owner reserves the right to submit the surface to the above tests at any time during the length of the guarantee. Consideration will be given to the time and use of the surface.

1.6 WARRANTY

- A. Warranty: Furnish 5 year written warranty, executed by Applicator and Contractor, certifying that the track and field surfacing complies with the following:
 - 1. Has been manufactured, applied and will perform in accordance with these and the manufacturer's specifications.
 - 2. Will hold fast and/or adhere to the primer, asphalt, concrete, edging filler, patches or overlay materials.

3. Is Ultra-Violet resistant, will not bubble, blister, fade, crack or wear excessively during the warranty period.
 4. Manufacturer/Installer shall repair free of charge high stress areas of the track (high jump, pole vault, long jump, triple jump take off) one time at the Owner's request.
- B. Provide a five (5) year manufacturer's warranty against workmanship and materials on the synthetic surface.

PART 2 - PRODUCTS

2.1 ACCEPTABLE SYSTEMS FOR POLYURETHANE BOUND, BLACK EPDM CRUMB BASE MAT WITH BLACK STRUCTURAL SPRAY:

BSS-100	by:	Benyon Sports Surfaces Hunt Valley, MD 21030 (410) 771-9473
POLYMAT SS:	by:	Fisher Tracks, Inc. Boone, IA 50036 (800) 432-3191
GTS SELECT SS	by:	Goddard Coatings Lake Orion, MI 48359 (248) 393-6320
POLYTRAC MS:	by:	Star Trac Southfield, MI 48034 (248) 354-2304
POLY 2000:	by:	Tennis Surfaces, Inc. Bartlett, Illinois 60103 (630) 213-1163

PART 3 - EXECUTION

3.1 BASE MAT

- A. The contractor shall clean the entire surface of all dirt and debris with a 5000 psi power washer prior to the application of any materials. Surface shall be free from all grease, oils and other foreign matter. The asphalt shall be allowed to cure for not less than fourteen (14) days and a concrete base a minimum of twenty-eight (28) days prior to any application of the urethane materials (weather permitting).
- B. The base mat shall consist of a mixture of one hundred percent (100%) polyurethane and synthetic materials, with no mineral or clay type fillers. The combination shall be of polyurethane and elastomeric granules consisting of EPDM granules. The base mat shall be free draining when cured. Granules shall consist of ambient ground EPDM rubber crumb not less than 1 mm and not more than 3 mm. Dust and the No. 200 sieve shall not exceed four percent (4%) of the total volume of rubber. The binder shall be a diphenylmethane diisocyanate base (100% MDI). Manufacturer of the polyurethane binder shall submit the Material Safety Data Sheets (MSDS), immediately upon request.

- C. The base mat shall be thoroughly mixed in one container. No evidence of water may exist during the mixing of the materials. All containers shall be completely empty to assure the proper ratio of mixture. The mixture shall consist of a ratio of polyurethane binder of not less than twenty percent (20%) of the combined weight to eighty percent (80%) of the combined weight of the mixture of EPDM rubber granules.
- D. No solvents or emulsifier agent shall be used in the binder to extend the cure of the mixture. The contractor shall submit all shipment documents and proper material volumes.
- E. The asphalt surface shall be allowed to cure for not less than fourteen (14) days prior to any work being done (weather permitting). This timetable shall be agreed upon by the Owner and the Application Contractor, based on the time of the year, and may be changed with the Landscape Architect's approval.
- F. After the asphalt has cured, the surface shall receive a prime coat of polyurethane at the rate of three-hundredths (0.03) to five-hundredths (0.05) gallons per square yard prior to the installation of the base mat.
- G. The base mat shall be applied by mechanically operated screed equipment, which shall be electrically heated. No fuel heaters shall be allowed. All hand rollers shall be electrically heated if used.
- H. The Pot Life of the base mat shall not be less than forty-five (45) minutes from the time of the completed mix. All trowel work shall be done within this time. Any areas that are rough, high, uneven or open in texture shall be sanded and filled prior to any finish work.
- I. All joint work shall be flush with the adjacent mat and shall have edges primed with the binder material if the adjoining mat has cured or set.
- J. The contractor shall install the all-weather surface at the elevation required per manufacturers installation guide for specified field event equipment.

3.2 TOP SURFACE

- A. This work shall consist of a blend of pigmented polyurethane and colored Ethylene Propylene Diene Monomer (EPDM) granules. The top surface shall be applied in multiple coats of two or more over the black base mat at the rate of 1.8 lbs. per square yard per coat (minimum 2-coat application).
- B. Granules shall be an ambient ground EPDM rubber crumb having a peroxide cure. The size of the material shall not be less than 0.5 mm and not more than 1.5 mm. The mixture shall include a fine content (dust) not to exceed ten percent (10%).
- C. Binder shall be pigmented polyurethane mixture of Methylene Diphenylene Isocyanide. The pigmented binder shall consist of a two (2) part mixture. The ratio of Polyol to binder shall be installed in accordance with the manufacturer's specifications. The catalyst shall be added at the mixing site, if necessary.
- D. The material ratio of the top surface shall consist of sixty percent (60%) binder (Polyol-binder) and forty percent (40%) EPDM granules. The spray operation shall be performed when the average wind velocity does not exceed five (5) to seven (7) mph. This operation shall be stopped immediately at this excess.

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- E. As required by manufacturer, the top surface materials shall contain a clear aliphatic polyurethane of not less than twenty-five percent (25%) of the binder. The material shall be included in all colored structural spray applications that are not black or terra cotta in color.
- F. The Owner shall reserve the right to have an anemometer on the site at this time. All work shall be protected from over spray outside the limits of the asphalt base.
- G. Final color and appearance shall be consistent along with the texture of the surface at all angles.
- H. No flooding or excess material over two (2) square feet shall be accepted. Excessive flooding constitutes poor workmanship and shall be reviewed and corrections determined at that time.

END OF SECTION 32 1826

SAMPLE TRACK WARRANTY

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.

1.2 NOTE

- A. The installation Contractor will be responsible for all tests that fail the specified characteristics. The Owner reserves the right to submit the surface to the above tests at any time during the length of the guarantee. Consideration will be given to the time and use of the surface.

1.3 GUARANTEE

- A. The Contractor shall be required to guarantee all labor, materials, workmanship and services for the All Weather Synthetic Track Surface and Track Markings.
- B. This guarantee shall remain in force for a period of not less than FIVE (5) YEARS from the date of written acceptance of the work.
- C. Any defects caused by cracks, normal abrasion or raveling that is not in original conformance with the testing specifications or structural in nature shall be repaired or replaced at no cost to the Owner during this guarantee period.
- D. This Contractor shall be required to submit the following documents in regard to the guarantee:
1. Letter from the manufacturer of all materials attesting to the guarantee length and limits. This must be signed by an officer of the organization.
 2. Letter of Guarantee from the Installation Contractor for the above time period.
 3. These documents shall be submitted to the Architect or Owner prior to final payment.

PART 2 - PRODUCTS

N/A

PART 3 - EXECUTION

N/A

LONG JUMP PIT SAND

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.
- B. Related Sections:
 - 1. Section 03 3000 Cast In Place Concrete
 - 2. Section 03 3010 Portland Cement Concrete
 - 3. Section 11 6840 Field Event Construction

1.2 SCOPE

- A. The work under this section of the specification shall consist of furnishing all labor, materials and equipment to produce, place, spread, compact and finish long jump sand to proper grade and cross section.

1.3 SUBMITTALS

- A. Submit to the Landscape Architect a sieve analysis of the proposed sand material to be installed.

PART 2 - PRODUCTS

2.1 SAND

- A. Sand material shall conform to DOT specifications for 2NS and 2MS categories and shall be placed to the minimum depth shown on plans.
 - 1. Contractor to mechanically mix the following blend of materials by volume:
 - 40% 2NS Sand
 - 60% 2MS Sand

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Place material in pit to a depth not less than 18".
- B. Crown sand in the center of pit (+3") to allow for settlement.
- C. Material, other than sand, which will not compact readily under roller, shall be removed and replaced with material which will compact readily and that portion of the sub-grade shall be rolled again.

END OF SECTION 32 1828

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CHAINLINK FENCE - GALVANIZED

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.
- B. Related Sections:
 - 1. Section 31 2000 Earthwork
 - 2. Section 03 3010 Portland Cement Concrete

1.2 SCOPE

- A. The work under this section of the specifications shall consist of furnishing all labor, materials and equipment necessary for a new chainlink fence system as indicated herein and on Contract Documents. Work shall include but not limited to footings, posts, fabric, rails, gates, and all related hardware.

1.3 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. American Society for Testing and Materials (ASTM):
 - a. ASTM C94 – Standard Specification for Ready-Mixed Concrete
 - b. ASTM A116 – Standard Specification for Metallic-Coated, Steel Woven Wire Fence Fabric
 - c. ASTM A120 – Standard Specification for Black and Hot-Dipped Zinc Coated (Galvanized) Welded Seamless Pipe
 - d. ASTM A491 – Standard Specification for Aluminum Coated Steel Chain Link Fence Fabric
 - e. ASTM F567 – Standard Practice for Installation of Chainlink Fence
 - f. ASTM F900 – Standard Specification for Industrial and Commercial Swing Gates
 - g. ASTM 1083 – Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
 - h. ASTM F1184 – Standard Specification for Industrial and Commercial Horizontal Slide Gates
- B. Weights and tolerances to conform to Federal Specification RR-F-191/1D, dated May 14, 1990. Mill certificates shall be made available at the request of the Landscape Architect or Owner.
- C. All material installed under this specification shall be subject to testing by the Owner. Any material so inspected and found to be not in strict conformance with this specification shall be promptly removed and replaced by the Contractor at his expense.

1.4 WARRANTY GUARANTEE

- A. The Contractor and any Sub-contractors hereunder guarantee their respective work against defective materials or workmanship for a period of one (1) year from the date of filing Certificate of Substantial Completion and as accepted by the Owner.

1.5 PROJECT CONDITIONS

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

1.6 QUALIFICATIONS

- B. Manufacturer: Company specializing in the manufacturing of products specified in this section with a minimum of ten (10) years experience
- C. Installer: Company specializing in performing work of this section with a minimum of five (5) years experience of comparable projects. Must have a minimum of two in-house fence installation crews.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver fence fabric and accessories in packed cartons or firmly tied rolls.
- B. Identify each package with manufacturer's name.
- C. Store fence fabric and accessories in a secure and dry place.

1.8 SUBMITTALS

- A. Shop drawings showing plan layout, spacing of components, post foundation dimensions, hardware, gates and schedule of components.
- B. Product Data: Submit product data on fabric pattern, posts, accessories, fittings, and hardware.
- C. At the request of the Architect, provide Material Certificates confirming product provided is Domestic pipe.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Framing Steel: ASTM F1083 domestic Schedule 40 galvanized steel pipe weighing three and sixty-five one-hundredths (3.65) lbs. per lineal foot or domestic SS-40 galvanized steel pipe weighing three and sixty-five one-hundredths (3.65) lbs. per lineal foot with hot dip galvanized zinc exterior and interior. Pipe shall utilize flow coat or inline galvanization process.
- B. Fabric Wire: ASTM A392 Class 1 zinc coated steel wire or aluminized steel wire.
- C. Concrete: ASTM C94; Portland Cement 3,500 psi strength at 28 days.

2.2 COMPONENTS

- A. Chain Link Fabric: The chain link fabric shall be 2" mesh, 9 gauge. Top and bottom selvage shall have knuckle finish. Fabric shall be free from barbs, icicles or other projections resulting from the aluminizing process, and any fabric not free thereof will be rejected even though erected. Bottom of fence fabric shall be 3/4" plus or minus 1/4" above grade.
- B. Line Posts: Line posts shall not be splice welded in such a manner that the weld appears above the grade line. All line posts shall have an outside diameter of 2 1/2". The chain link fabric shall be tied to the line posts with No. 9 gauge annealed galvanized steel tie wire. Fence fabric shall be secured to line posts no more than 18" O.C., with excess wire cut off and turned down.
- C. Terminal and Gate Post: Terminal and gate posts shall not be splice welded in such a manner that the weld appears above the grade line. End, corner and gate posts shall have an outside diameter of 3" and weight of not less than five and seventy-nine one-hundredths (5.79) lbs. per lineal foot. Post

caps at terminal posts shall be securely fastened to prevent removal.

- D. Terminal and Gate Post Fittings: Terminal and gate post fittings including tension bands, brace connections and top rail connections shall be No. 11 gauge. Hot-dipped iron or pot metal fittings will be accepted as equals or substitutes. Top rail, brace and truss bands shall not be less than one inch (1") wide, secured by five-sixteenths inch (5/16") diameter carriage bolts and nuts.
- E. Top Rail: Top rail shall meet the same specifications of quality as line and terminal posts. The top rail shall have an outside diameter of one and five-eighths inches (1-5/8") and weigh two and twenty-seven one-hundredths (2.28) lbs. per lineal foot. An outside sleeve-type coupling measuring not less than 6" in length shall be provided at each interval of twenty feet (20'). The chain link fabric shall be tied to the top rail at intervals of twenty-four inches (24") with No. 9 gauge annealed galvanized steel tie wire. Rail(s) shall be securely fastened by means of suitable malleable iron or pressed steel connections. The terminal ends of all top, bottom, mid and bracing rails shall utilize boulevard hardware that prevents insects from gaining access into top rails.
- F. Braces and Terminal Gate and Gate Posts: Terminal and gate posts shall be strengthened and reinforced by braces meeting the same specifications of quality as line and terminal posts. Braces shall be installed midway between top rail and grade and extend from each terminal post to the first adjacent line posts. Braces shall be securely fastened to posts by heavy pressed steel connections and also be trussed from line posts back to terminal post with a three-eighths inch (3/8") round truss rod complete with tightened unit.
- G. Bottom Tension Wire: Bottom tension wire shall be No. 6 gauge galvanized steel coil tension wire, high carbon or hard drawn, Class II, Aluminum Coated, fastened to the chain link fabric at intervals of twenty-four inches (24") with No. 11 gauge galvanized steel hog rings.
- H. Post Spacings and Settings:
1. Gate, terminal and end posts shall be set in concrete foundation not less than twelve inches (12") in diameter and not less than forty-two inches (42") in depth. Concrete shall attain a compressive strength of not less than three thousand five hundred (3,500) lbs. per square inch at the twenty-eighth (28th) day after pouring. Spacing of posts in the line of fence shall be uniform. See plans for dimensions.
 2. Line posts can either be set in concrete foundations as noted above or pneumatically driven.
 3. Refer to Chart in Section 3.2, A.
- I. Gates:
1. Gates shall be not less than four feet (4') wide and constructed and hung as detailed on drawings.
 2. Frames shall be constructed of pipe, having an outside diameter of 1.9" or alternately, being two inches (2") square and weighing two and seventy-two one-hundredths (2.72) lbs. per lineal foot. Gate frames shall be welded, or alternately, shall utilize corner fittings of heavy malleable iron or pressed steel securely riveted to the frame.
 3. Fabric matching the system fence fabric shall be installed in the frame by means of tension bars and hook bolts.
 4. Frames having corner fittings shall be equipped with adjustable truss rods having a diameter of three-eighths inches (3/8").
 5. Hinges shall be of adequate strength to support the gate and have large bearing surfaces for clamping in position. Under no conditions of use or abuse shall the hinges twist or turn under action of the gate.
 6. Gates shall be capable of being opened and closed quickly and easily by one (1) person. Gates shall be equipped with a positive strong arm latching device that will accommodate padlocking. A plunger rod, catch and semi-automatic outer catch shall be installed on drive gates so as to

secure gates in an open position. Hinges, latches and catches shall be approved by the Landscape Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
 1. Do not begin installation before final grading is completed unless permitted by Architect.
 2. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Stake locations of fence lines, gates and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks and property monuments.

3.2 INSTALLATION

- A. All posts shall be set plumb and in accordance with the following table (unless specified otherwise):

1. Corner/Terminal and Bracing Post - General Fence

Fabric Height	Post Depth	Diameter of Foundation	Foundation Depth	Maximum Spacing
0' - 6'-0"	36"	12" min	42"	10'-0"
6'-1" - 12'-0"	36"	12" min	42"	10'-0"

2. Line posts shall be pneumatically driven into the ground using the following chart*:

Fabric Height	Pipe Below Grade	Total Length of Post
4'	4'	8'
6'	5'	11'
8'	6'	14'
10'	7'	17'
12'	8'	20'

- B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 1. Verify that posts are set plumb, aligned and at correct height and spacing, and hold position during setting with concrete or mechanical devices.
 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
- D. Fence posts shall be installed with maximum 6 inches clear opening from end posts to buildings, fences, property lines or other structures.
- E. Install gates level, plum and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Adjust hardware for smooth operation and lubricate where necessary.

- F. The fabric shall be installed on the court/playing side of posts. Bottom of fence fabric shall be 3/4" (+/-1/4") above the finished court surface. Fabric shall be furnished with selvage knuckled on both ends.
- G. Top of concrete footing shall be left down and topped with surrounding pavings as detailed. Asphalt cold patch is not acceptable.

3.3 CLEAN UP AND DISPOSAL

- A. Remove from the site all equipment, materials, and debris resulting from construction work included in this section. Leave work area neat and clean and in a condition acceptable by the Landscape Architect and Owner. All work shall be complete, ready for use, at the time of final acceptance.

END OF SECTION 32 3100

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WATER DISTRIBUTION SYSTEM – SYNTHETIC TURF

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.
- B. Work Includes:
 - 1. Sleeving for the irrigation system (see drawing for size and type)
 - 2. Point of Connection: Contractor shall connect to existing irrigation mainline. Verify location in the field.

1.2 SCOPE

- A. Install a complete and working underground water distribution system according to plans and specifications provided.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Irrigation products shall be by a single manufacturer. All irrigation system components shall be supplied by the regionally authorized distributors to provide single source responsibility for warranty service and operations to conform to specifications in all respects.

1.4 JOB CONDITIONS

- A. Site Conditions:
 - 1. The Contractor shall coordinate his work with that of other trades wherever possible.
 - a. Existing Utilities and Conditions
 - i. Before excavation, the Contractor shall obtain location of all cables, conduits, sewers, septic tanks, and other utilities, and shall be cautious as not to damage them. If such obstacles conflict with the proposed work, the Contractor shall immediately notify the owner's representative for arrangements for relocation.
 - ii. In the event of damage, the contractor shall repair or replace these lines to the satisfaction of the Owner's Representative at no cost to the Owner.
 - 2. It is the Irrigation Contractor's responsibility to verify that all sleeving is installed under paving in locations as shown on drawings.

1.5 SUBMITTALS

- A. Submit manufacturer's data sheets for all materials (quick coupler valves, swing joints, pipe) and all other related items to owner's representative.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. QCV shall be manufactured by the Rainbird or approved equal.

2.2 MATERIALS

A. Pipe

1. PVC Pipe: All PVC pipe shall be pressure pipe as manufactured by J-M Manufacturing or Cresline Plastic Pipe Company. High-impact virgin polyvinyl-chloride (PVC-1120) conforming to NSF Standard 14 and ASTM D-2241 for thermoplastic pipe with minimum 160 PSI test strength. Pipe shall have standard thermoplastic pipe dimension ratio of SDR-26 and shall be marked with the manufacturer's name, materials, size and schedule. Pipe shall conform to the U.S. Department of Commerce Commercial Standard CS255-63-3408 or latest revision thereof. Pipe shall be suitable for potable water and shall bear the "NSF" trademark. See drawing for sizes specified.

B. Pipe Sleeves

- | <u>Pipe Sleeve Size</u> | <u>Sleeve Size</u> | <u>Sleeve Type</u> |
|-------------------------|--------------------|----------------------------|
| 3/4" to 1" | 2-inch | PVC 160 or Sch.40 DWV pipe |
| 1-1/4" to 1-1/2" | 3-inch | PVC 160 or Sch.40 DWV pipe |
| 2" to 2-1/2" | 4-inch | PVC 160 or Sch.40 DWV pipe |
| 3 inch | 6-inch | PVC 160 or Sch.40 DWV pipe |
| 4 inch | 8-inch | PVC 160 or Sch.40 DWV pipe |
| 6 inch | 10-inch | PVC 160 or Sch.40 DWV pipe |
- (Sleeve sizes and locations are based on a single pipe being installed in a sleeve. Contractor shall verify sleeve sizes with drawing.)

C. Fittings

1. PVC Pipe Fittings: All fittings 1-1/2" through 3" shall be Schedule 40 PVC solvent weld, type 1, meeting the requirements of ASTM D-2466. No saddles allowed. All 4" fittings shall be gasketed joint Harco PVC Class 200 meeting ASTM D1784 DR21 requirements. Bell shall be gasket joint conforming to ASTM3139 with gaskets conforming to ASTM F477. Fittings 6" and larger shall be Harco Ductile Iron Fittings manufactured with a grade of 65-45-12 in accordance with ASTM F-477 requirements.
2. Polyethylene Fittings: All fitting 1-1/4" and smaller downstream of control valve shall be plastic or insert type fittings where applicable. All 1-1/4" fittings shall be double clamped with all stainless steel worm gear clamps. All 1" and smaller fittings shall be clamped with all stainless steel worm gear clamps or all stainless steel crimp clamps.

- D. Quick Coupling Valves: Quick coupler valves shall be 1" one-piece brass body with a rubber cover as manufactured by Rainbird. Provide an equal number of quick coupler keys for number of quick coupler valves installed. Quick coupler keys shall also include fitting to allow for easy attachment to a standard garden hose.

- E. Solvent and Primer: Solvent and primer used on PVC pipe shall meet the requirements of ASTM D-2564 and shall be approved by the National Sanitation Foundation. All solvent and primer to be used in accordance with manufacturer's specification. Primer to be purple in color. Solvent shall be used to change its viscosity. If viscosity or consistency is unsuitable, the solvent shall not be used.

F. Swing Joints:

1. All sprinkler heads 6 GPM or less shall be attached to the piping with two-elbow joints consisting of 3/8" flexible pipe and coordinating elbows.
2. All quick coupling valves shall be installed using a galvanized swing joint assembly consisting of

three galvanized nipples (2) 2"; (1) 4" and (1) 12". Size shall match inlet size of quick coupling valve.

G. Quick Coupler Valve Monument Box:

1. Quick coupler valves shall be housed in a pre-manufactured stainless steel box. Synthetic turf shall be affixed to lid to create a flush surface.

- | | | | |
|-------------------|-------------------------|------------------|---------|
| 1. Single QCV Box | Sportsfield Specialties | TC-3700-OCV Plus | 4 total |
| 2. | | | |

PART 3 - EXECUTION

3.1 Layout and Staking

- A. Piping Layout: Piping layout is diagrammatic and contractor shall verify site conditions.
- B. Staking: All quick coupler valves and mainline line routing shall be staked prior to installation for approval upon request of the Owner's Representative.

3.2 TRENCHING

- A. Trenches shall be excavated so that irrigation lines are installed with the following minimum depths for pipe cover:
 1. All polyethylene lateral pipe: Minimum depth - 15".
 2. All PVC lateral pipe 3/4" and 1": Minimum depth - 12".
 3. All PVC pipe: Depth is specified below:

1-1/2" - 2" pipe size	16" cover
2 1/2" - 4" pipe size	20" cover
6" - 8" pipe size	24" cover
10" pipe size	30" cover
 4. All wire:

115V power wire - 24" or as required by code.
24V control wire - 14" or as required by code.
Hydraulic control tubing - 14" minimum.
- B. All PVC piping shall be trenched. PVC pipe 2-1/2" and smaller may be pulled with approval of owner's representative if proper soil conditions exist and minimum depth requirements are maintained.
- C. Polyethylene distribution pipe may be pulled, with approval of owner's representative, if proper soil conditions and minimum depth requirements are maintained.
- D. Trench excavation in excess of required depth shall have bottom graded and tamped prior to any pipe replacement.
- E. Where trenching of PVC or polyethylene pipe lines is not possible because of adverse soil conditions or obstructions, and backbone operation is required, provide labor, materials and equipment for this operation, including full trench backfilling with soil if required in operation of owner's representative. Restoration of the area, as directed by owner's representative. It shall be part of this contract and shall be performed in the following manner:
 1. Return to grade with native soil. Backfill material shall be free from debris, including rocks, large

stones, clay clumps or other unsuitable substances and care shall be taken to prevent settling and damage to pipe during and after backfilling operations. When backfilling, soil shall be tamped in 6-inch layers with minimum of 6 inches of acceptable soil in turf areas and 12 inches in plant bed areas.

- F. Depth of sleeves shall be as noted on installation and details on drawing.
- G. Pavement: Where existing pavement must be cut to install irrigation system, cut smoothly in straight lines 6 inches wider than trench.
 - 1. Excavate to required depth and width.
 - 2. Remove cut-out pavement and excavated material from the site.
 - 3. Backfill with dry sand fill material, placing in 6-inch lifts.
 - 4. Repair or replace pavement cuts with equivalent materials and finishes.
 - 5. At walkways, jack piping under pavement material, if possible.

3.3 INSTALLATION

- A. General: Unless otherwise indicated, comply with requirements of Uniform Plumbing Code.
- B. Piping:
 - 1. All mainlines and headers shall be kept to a minimum to 2 feet from all existing or proposed trees.
 - 2. Polyethylene pipe connectors shall be made with insert fittings held tightly in place with worm gear driven stainless steel clamps and screws at ferrules. Pipe sizes 1-1/4" and larger in diameter shall be double clamped.
 - 3. PVC pipe shall be laid on solid undisturbed soil or on thoroughly compacted full bed of sand so as to assure full bedding, proper alignment and minimum slope for drainage.
 - 4. PVC pipe ends and PVC fittings shall be thoroughly cleaned for full depth of fitting with liquid cement. Method of application shall be in accordance with manufacturer's recommendations for solvent weld connectors.
 - 5. Lay pipe on solid subbase, uniformly sloped without humps or depressions.
 - 6. Install PVC pipe in dry weather when temperature is above 40°F (4 degrees C) in strict accordance with manufacturer's instructions. Allow joints to cure at least 24 hours at temperature above 40°F (4 degrees C) before testing, unless otherwise recommended by manufacturer.
- C. Connection to Water Source: Point of connection shall be as indicated on drawings. Contractor shall verify point of connection with owner's representative.
- D. On synthetic turf applications, monument box shall abut concrete turf anchor.

3.4 THRUST BLOCKS

- A. Provide concrete thrust blocks on side of mainline pipe wherever pipe changes direction at tees, bends, or dead ends, and at any other location where thrust is to be expected.
- B. Refer to pipe manufacturer's recommendations for type and method of thrust blocks.

3.5 BALANCE AND ADJUSTMENT

- A. The contractor shall flush all lines and evacuate all air and debris from the system. After completion, testing and acceptance of the system, instruct the owner in the operation and maintenance of the system.

3.6 MAINTENANCE, GUARANTEE AND WARRANTY

- A. Contractor shall provide two (2) brass quick coupler keys with swivels to Owner that match system installed. System installed shall allow Owner to attach garden hose or water cannon to quick coupler key.
- B. A full two (2) year manufacturer's warranty on all quick coupler valves shall be provided by the Irrigation Contractor. Any part proven to be defective within the 2 year warranty period shall be replaced with no cost to the owner for parts. After the 1 year labor warranty has expired, the owner shall be responsible for the labor to replace defective materials.

END OF SECTION 32 8420

MELVINDALE-NORTHERN ALLEN PARK PUBLIC SCHOOLS

ATHLETIC FACILITY IMPROVEMENTS

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GENERAL LAWN RESTORATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.
- B. Related Sections:
 - 1. Section 31 2000 Earthwork

1.2 SCOPE

- A. The work under this section of the specifications shall consist of furnishing all labor, materials and equipment necessary for restoring disturbed lawn areas and maintaining lawns until final acceptance.

1.3 QUALITY ASSURANCE AND WARRANTY GUARANTEE

- A. Grass seed shall meet the tolerance for germination and purity of the Official Seed Analysis of North America.
- B. Submit all seed tags after completion of seeding.
- C. The Contractor, and its Subcontractors, shall provide a staff adequate to coordinate and expedite the work properly and shall maintain competent supervision of its own work to insure compliance with contract requirements.
- D. Contractor responsible for seeding and fertilizing shall inspect the finish grade for acceptability prior to application. Areas of discrepancy shall be identified and Landscape Architect or Owner's Representative shall be notified.
- E. It is the responsibility of the Contractor to establish a dense lawn of permanent grasses, free from lumps, depressions and settlement. Any part of the area that fails to show a uniform germination shall be re-seeded and such re-seeding shall continue until a dense lawn is established. Damage to seeded areas resulting from erosion and through no fault of the Owner shall be repaired by the Contractor, at his expense.
 - 1. Guarantee shall extend for one year from the date of acceptance.

1.4 SUBMITTALS

- A. Submit product data for seed and fertilizer to Landscape Architect for approval, prior to application.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver grass seed in original containers showing analysis of seed mixture, percentage of pure seed, year of production, net weight, date of packaging and location of packaging. Damaged packages are not acceptable.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

PART 2 - PRODUCTS

2.1 SEED

A. Seed shall be provided from one of the following suppliers

- EcoGreen Supply- 616-877-5326
- John Deere Landscapes - (800) 347-4272 (now Site One Landscapes)
- TurfGrass, Inc. – (248) 437-1427 (now Residex)
- Commerce Corp. – (800) 243-4769- closed (now BFG)
- Rhino Seed & Supply - (800) 482-3130
- Michigan State Seed Solutions - (800) 647-8873 (now Lacrosse Seeds)
- Tri Turf – (800) 636-7039

B. Contractors shall seed all areas disturbed during construction and not otherwise developed or indicated to be sodded. Topsoiling, finish grading and fertilization is to remain the same. *Seed shall be new crop, cleaned, and comprising of the following varieties:

1. Athletic Field Seed blend shall consist of a minimum of 3 of the listed bluegrass varieties and one of the listed ryegrass varieties. Blend shall be 80% Kentucky Bluegrass and 20% Perennial Ryegrass by weight. Only Elite bluegrasses (according to NTEP characteristics ratings) will be allowed on Athletic surfaces. No “named common” types will be accepted. Enhanced Elite varieties will be allowed at same seeding rates.
2. General Seeding Areas: “Varieties Named” blend shall be 50-60% Kentucky Bluegrass and 40-50% Perennial Ryegrass by weight for irrigated fields. A “Varieties Named” blend of 60-70% bluegrass, 30-40% perennial ryegrass for non-irrigated fields, and a blend of 20-40% bluegrass, 20-40% perennial ryegrass and 20-30% creeping red fescue for general turf areas.(VNS-varieties not stated- blends will not be accepted)
3. Athletic Fields

<u>Seed Varieties</u>	<u>Purity</u>	<u>Germination</u>
• Shannon Kentucky Bluegrass	95%	85%
• Lunar Kentucky Bluegrass	95%	85%
• SPF 30 Kentucky Bluegrass	95%	85%
• Fullback Kentucky Bluegrass	95%	85%
• Midnight Kentucky Bluegrass	95%	85%
• Hampton Kentucky Bluegrass	95%	85%
• Gaelic Kentucky Bluegrass	95%	85%
• BlueBank Kentucky Bluegrass	95%	85%
• Noble Kentucky Bluegrass	95%	85%
• Touchdown Kentucky Bluegrass	95%	85%
• Salinas Perennial Ryegrass	95%	85%
• Gray Star Perennial Ryegrass	95%	85%
• Sox Fan Perennial Ryegrass	95%	85%

4. General Seeding Areas

<u>Seed Variety</u>	<u>Purity</u>	<u>Germination</u>
• Shannon or Bluestar Kentucky Bluegrass	98%	85%
• Gaelic or Corsair Kentucky Bluegrass	98%	85%
• Lunar or Avalanche Kentucky Bluegrass	98%	85%
• Gray Star or Salinas Perennial Ryegrass	98%	90%
• SoxFan or Showtime Perennial Ryegrass	98%	90%
• Charger 2 Perennial Ryegrass	98%	90%
• Oracle Creeping Red Fescue	98%	85%

2.2 COMMERCIAL FERTILIZER

- A. Fertilizer shall be uniform in composition, free-flowing and suitable for application with approved spreader, granular or pelleted with 50 percent (50%) of total nitrogen derived from a synthetic or natural organic material, delivered in original unopened containers with the analysis, type and trade name attached to each container. The composition shall be:

Fertilizer "A": applied at the time of seeding at 50 lbs. per 8000 square feet.
16-32-4 (14.3% Ammoniacal Nitrogen, 1.7% Urea Nitrogen, 32% Phosphorus, 4% Available Potassium (SOP))

Fertilizer "B": applied 3-4 weeks after seeding at 50 lbs. per 8,000-10,000 square feet.
22-16-6 (6.3% Ammoniacal Nitrogen, 15.7% Urea Nitrogen, 16% Phosphorus, 6% Soluble Potassium.

Fertilizer "C" for enhanced establishment program (seed in lieu of sod)
5-5-5 with Mycorrhiza (1.7% Ammoniacal Nitrogen, 3.3% Water Insoluble Nitrogen, 5% Available Phosphorus, 5% Available Potassium, 4% Calcium, 2.5% Magnesium, .2% Copper, 5% Iron, .2% Manganese, .2% Zinc, complete Mycorrhiza and Bacterial Package.

Fertilizer "D" for enhanced establishment program (seed in lieu of sod)
15-0-7 with Broad Spectrum Innoculant (bacterial package (.75% Ammoniacal Nitrogen, 3.75% Urea Nitrogen, 3.50% other water soluble nitrogen, 7% water insoluble nitrogen, 7% soluble potash, 1% Calcium, .5% Magnesium, 1% Sulphur, .1% Copper, 1% Iron, .5% Manganese, .1% Zinc. 100% slow release nitrogen derived from Feather Meal and Methylated Urea.

- B. Complete Soil testing for both fertility (including micronutrients, CEC, pH) and particle size is **required** on all new establishment sites
- C. A critical establishment fertilizer application comes at planting whereas fertilizer in a ratio of 2-4-1 is applied directly adjacent to the seed to compensate for the seeds inability to extract phosphorus and other nutrients out of the soil. Usually approx. 1lb. of P205 is applied with ½ lb. of N and ¼-½ lb of K20 is applied. An analysis of 16-32-4 would be an example. Fertilizer ingredients with lower chloride index are preferred at seeding, such as Ammonium Sulfate and Sulfate of Potash.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect existing underground improvements from damage.
- B. Remove all foreign materials, plants, roots, stones, and debris larger than 1" in any dimension from site. Do not bury foreign material.
- C. Loosen soil to a depth of four inches (4") in lawn areas by approved method of scarification and grade to remove ridges and depressions. Remove all stones or foreign matter from top two inches (2") of soil.
- D. If above steps have had rain in sufficient quantity to cause soil to recompact, entire steps are to be done prior to seeding.

- E. Where no grades are shown, areas shall have a smooth and continual grade between existing or fixed controls and elevations shown on plans. Roll, scarify, rake and level as necessary to obtain true, even lawn surfaces. All finish grades shall meet approval of the Owner.
- F. Grade lawn areas to finish grades, filling as needed or removing surplus dirt and floating areas to a smooth, uniform grade. All lawn areas shall slope to drain.

3.2 PREPLANT FERTILIZING

- A. Broadcast spread fertilizer "A" (or Alternates "C" and "D") after seeding at a rate of 2 lbs. of Phosphorus per 1000 square feet. (Apply Alternate "C" at 50 lbs. per 5000 square feet and Alternate "D" at 50 lbs. per 10,000 square feet.)

3.3 SEEDING

- A. Dates of Seeding:
 - 1. Grass seed shall be sown in the fall from August 15th until October 15th or in the spring between March 1st and May 15th or at such other times as approved by the Landscape Architect. All seeding is to be done in dry or moderately dry soil and at times when the wind does not exceed a velocity of five (5) miles per hour.
 - 2. If special conditions exist, which may warrant a variance in the above dates, submit a written request to the Landscape Architect stating the conditions and proposed variance. Permission for the variance will be given if, in the opinion of the Landscape Architect, the variance is warranted.
- B. Seed Application:
 - 1. Immediately before sowing the seed, the earth surface shall be re-worked until it is a fine, pulverized, smooth seedbed, showing not more than 1/4" variance from grade.
 - 2. Apply seed mixture, as specified, at a rate of two and one half to four (2.5-4) lbs/1000 sq. ft. Apply seed in two directions where possible at a rate of 1.25-2 lbs. /1000 sq. ft. in each direction with seeder, using a cultipacker type seeder such as Brillion (or equal) mounted on tractor. Seed shall be uniformly spread over the previously fine graded and fertilized topsoil. The surface shall be dry when seed is planted. Hand sow seed around each irrigation system head. **Hydro-seeding is not acceptable.**
 - 3. Mulching: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches (150mm) long.
 - 4. Contractor shall return to site six (6) weeks after installation to remove mesh.
- C. Summer Seeding:
 - 1. If seeding is authorized between June 1 and August 15, annual rye shall be sown separately in addition to specified seed mix. Sow at the rate of (one) 1 lbs./1000 sq. ft.
 - 2. Cultipacker or approved similar equipment may be used to cover the seed and to firm the seed bed in one operation. In areas inaccessible to cultipacker, the seeded ground shall be lightly raked and rolled in two directions with a water ballast roller. Extreme care shall be taken during seeding and raking to insure that the seed is not raked from one spot to another.
 - 3. The seeded areas are to be protected, watered, mowed and otherwise maintained until Owner Acceptance.
- D. Post Seeding Fertilizer: Supply fertilizer "B" when grass reaches height of one (1) inch or 3 weeks

after seeding at .75-1 lbs Phosphorus per 1000 square feet.

E. Maintenance

1. Maintenance of all lawns consist of mowing, watering and repairing erosion. Maintenance of lawns shall commence when any portion of the seeding has been completed. Seeded lawns shall never reach a height of three (3) inches prior to a cutting and shall be cut to a height of two (2) inches.
2. If, for reasons beyond the Sub-contractor's control, the height of the grass has exceeded three (3) inches, the mower blades shall be raised so that at no time will more than 1/3 of the grass leaf surface be removed.
3. Contractor shall notify the Owner through the Landscape Architect in writing one (1) week in advance of the final lawn cutting to allow the Owner and the Landscape Architect to inspect the lawns and schedule his maintenance work. The Owner will accept the lawns after a minimum of three (3) cuttings if a uniform cover of grass is established and is acceptable to Owner and Landscape Architect.
4. If an infestation of weeds or crab grass develops prior to acceptance of the lawn, the Contractor shall treat the infestation by hand weeding or chemical control. The chemical control shall be furnished and installed by the contractor as recommended by the manufacturer and approved by the Landscape Architect. At least two weeks shall elapse after chemical control is applied before a request or inspection for acceptance is made to the Landscape Architect.

3.4 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Architect:
- a. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over an 10 square foot and bare spots not exceeding 5 by 5 inches.
 - b. Use specified materials to reestablish turf that does not comply with the requirements and continue watering and maintenance until turf is satisfactory.

3.5 CLEAN UP AND DISPOSAL

- A. Remove from the site all equipment, materials, and debris resulting from construction work including this section. Leave work area neat and clean and in a condition acceptable by the Landscape Architect and School District. All work shall be complete, ready for use, at the time of final acceptance.

END OF SECTION 32 9227

MELVINDALE-NORTHERN ALLEN PARK PUBLIC SCHOOLS

ATHLETIC FACILITY IMPROVEMENTS

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DECEMBER 18, 2017

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SUBDRAINAGE SYSTEMS - SAND

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.
- B. Related Sections
 - 1. Section 04 0513 Mortar
 - 2. Section 31 2000 Earthwork
 - 3. Section 31 2010 Earthwork (Turf)
 - 4. Section 33 4413 Manholes, Catch Basins and Similar Structures

1.2 SCOPE

- A. The work under this section consists of furnishing all labor, materials and equipment to install the drainage system, couplings and accessories for an operating sub-drainage system.

1.3 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. American Society for Testing and Materials (ASTM):
 - a. ASTM D1785 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe
 - b. ASTM D3350 – Standard Specification for Polyethylene Plastics Pipe and Fitting Materials
 - c. ASTM F405 – Standard Specification for Corrugated Polyethylene Pipe and Fittings
 - 2. American Association of State Highway and Transportation Officials (AASHTO):
 - a. AASHTO M294 – Standard Specification for Corrugated Polyethylene Pipe

1.4 SUBMITTALS

- A. Manufacturer's Literature: Furnish to Landscape Architect, copies of manufacturer's specifications, maintenance, and installation instructions for each item specified herein. Include photographs, catalogue cuts, and other data as may be required to show compliance with these specifications.

PART 2 - PRODUCTS

2.1 DRAINAGE TILE

- A. Single wall corrugated polyethylene tubing (without filter wrap) complete with required couplings and fittings. Perforation Type: Fine Slot
- B. Schedule 40 PVC complete with accessories and appropriate solvent to be used where indicated. SDR 35 may be substituted where the pipe has a minimum of 18" cover.

2.2 BACKFILL

- A. MDOT 2NS approved sand to be used as backfill material.

PART 3 - EXECUTION

3.1 INSTALLATION FOR CORRUGATED POLYETHYLENE TUBING

- A. Hand trim excavating to required elevations. Do not over excavate. Remove large stones or other hard matter which could damage drain tile.
- B. Place a two inch (2") thick bed of filter aggregate.
- C. Install the drainage tile on the filter aggregate bed.
- D. Ensure complete connection to storm sewer using perforated pipe.
- E. Cover the pipe with filter aggregate to top of trench and compact to 90% Modified Proctor.

END OF SECTION 33 4600

SUBDRAINAGE SYSTEM – FLAT DRAINTILE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.
- B. Related Sections
 - 1. Section 31 2010 Earthwork - Turf
 - 2. Section 31 3219 Geotextile Fabric
 - 3. Section 32 1815 Synthetic Turf

1.2 SCOPE

- A. The work under this section consists of furnishing all labor, materials and equipment to install the drainage system, couplings and accessories for the artificial turf subdrainage system.

1.3 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. American Society for Testing and Materials (ASTM):
 - a. ASTM D2729 – Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 - b. ASTM D3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
 - 2. American Association of State Highway and Transportation Officials (AASHTO):
 - a. AASHTO M294 – Standard Specification for Corrugated Polyethylene Pipe

1.4 SUBMITTALS

- A. Manufacturer's Literature: Furnish to Landscape Architect, copies of manufacturer's specifications, maintenance, and installation instructions for each item specified herein. Include photographs, catalogue cuts, and other data as may be required to show compliance with these specifications.

PART 2 - PRODUCTS

2.1 DRAINTILE - GENERAL

- A. High Density corrugated polyethylene (HDPE), tubular-style perforated type, pipe and fittings.
- B. Hancor "HI-Q", ADS N-12, or approved equal.
- C. Diameter of systems lateral and collector lines as shown on plans.

2.2 DRAINTILE - FLAT DRAIN

- A. AdvanEDGE pipe with geotextile sock manufactured by Advanced Drainage Systems, Inc. (800) 733-9554. Size as indicated on Drawings.

- B. Multi-Flow manufactured by Varicore Technologies, Inc., (800) 978-8007. Size as indicated on Drawings.

2.3 TRENCH MATERIAL

- A. Filter Aggregate: Evenly graded mixture of $\frac{3}{4}$ " diameter clean crushed stone.

PART 3 - EXECUTION

3.1 INSTALLATION FOR CORRUGATED POLYETHYLENE TUBING

- A. Hand trim excavating to required elevations. Do not over excavate. Remove large stones or other hard matter which could damage drain tile.
- B. Place a two inch (2") thick bed of filter aggregate.
- C. Install the drainage tile on the filter aggregate bed.
- D. Ensure complete connection to storm sewer using perforated pipe.
- E. Cover the pipe with filter aggregate to top of trench and compact to 90% Modified Proctor.

3.2 INSTALLATION FOR "FLAT DRAIN" PIPE

- A. Install flat drain pipe horizontally, being sure to allow for a minimum of 8" of stone below turf material.
- B. Joints shall be made using manufacturers couplers prior to placing flat drain on subgrade. Use 2 coupling pins for each coupler. Couplers shall be placed under the fabric at the joint to prevent backfill infiltration. To accomplish this, split the fabric seam and lay back the fabric approximately 8". Install the coupler with 2 pins. Replace fabric over the coupler and secure the fabric with suitable tape.
- C. End caps shall be used at all termination points to prevent soil infiltration into system.
- D. Compact stone to appropriate modified proctor density value.

END OF SECTION 33 4605

SUBDRAINAGE SYSTEMS - PEASTONE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.
- B. Related Sections
 - 1. Section 04 0513 Mortar
 - 2. Section 31 2000 Earthwork
 - 3. Section 31 2010 Earthwork - Turf
 - 4. Section 33 4413 Manholes, Catch Basins and Similar Structures

1.2 SCOPE

- A. The work under this section consists of furnishing all labor, materials and equipment to install the drainage system, couplings and accessories for an operating sub-drainage system.

1.3 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. American Society for Testing and Materials (ASTM):
 - a. ASTM D1785 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe
 - b. ASTM D3350 – Standard Specification for Polyethylene Plastics Pipe and Fitting Materials
 - c. ASTM F405 – Standard Specification for Corrugated Polyethylene Pipe and Fittings
 - 2. American Association of State Highway and Transportation Officials (AASHTO):
 - a. AASHTO M294 – Standard Specification for Corrugated Polyethylene Pipe

1.4 SUBMITTALS

- A. Manufacturer's Literature: Furnish to Landscape Architect, copies of manufacturer's specifications, maintenance, and installation instructions for each item specified herein. Include photographs, catalogue cuts, and other data as may be required to show compliance with these specifications.

PART 2 - PRODUCTS

2.1 DRAINAGE TILE

- A. Perforated corrugated polyethylene tubing (with filter wrap) complete with required couplings and fittings.

2.2 PEASTONE

- A. 3/8" minus peastone to be used as backfill material.

PART 3 - EXECUTION

3.1 EXECUTION FOR CORRUGATED POLYETHYLENE TUBING

- A. Hand trim excavating to required elevations. Do not over excavate. Remove large stones or other hard matter which could damage drain tile.
- B. Place a two inch (2") thick bed of filter aggregate.
- C. Install the drainage tile on the filter aggregate bed.
- D. Ensure complete connection to storm sewer using perforated pipe.
- E. Cover the pipe with filter aggregate to top of trench and compact to 90% Modified Proctor.

END OF SECTION 33 4615

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 site and/or building concrete work. This section also includes fill for steel deck and fill for steel pan stairs.
- B. Related work specified elsewhere:
 - 1. Section 05120 - embedded structural steel items.
 - 2. Section 05500 - metal fabrications.

1.03 SUBMITTALS

- A. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures". Indicate reinforcement sizes, spacings, locations, and quantities, bending and cutting schedules, supporting and spacing devices.
- B. See structural 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.

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- 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. Standard Practice for Curing Concrete (ACI 308).
- G. Specification for Structural Concrete (ACI 301).
- H. Guide for Concrete Floor and Slab Construction (ACI 302.1R).
- I. Guide to Formwork for Concrete (ACI 347R).
- J. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice.
- K. 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. Form Release Agent: Colorless mineral oil which will not stain the concrete or impair natural bonding characteristics of coating intended for use on concrete.

I. 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.

J. Vapor Barrier: 6 mil thick, clear polyethylene film, type recommended for below grade application.

K. 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 lags 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. Bonding Agent: Polymer resin emulsion, W.R. Grace or reviewed/approved equal.
- H. 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 6000 psi at 28 days.
- I. Adhesive Anchoring: Injectable adhesive or self-contained capsule as manufactured by:
 - 1. 'Hilti' HIT or HVA 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 Company 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 Sill 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. All other concrete - 3500 psi. 28-day compressive strength; water-cement ratio, 0.51 maximum
 2. Footings, walls and piers - 3000 psi. 28-day compressive strength; water-cement ratio, 0.58 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. Reinforced Foundation Systems: Not less than 1" and not more than 4".
 2. All Other Concrete: Not less than 1" & not more than 4".
 3. Concrete containing high-range water-reducing admixture (superplasticizer). Not more than 8 inches after adding admixture to site-verified 2-3 inch slump concrete.
 4. 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. Select admixture proportions for normal weight concrete in accordance with ACI 301, Method 1, and in strict accordance with manufacturer's instructions.
- F. Air Entraining Agent: Use in all exterior concrete exposed to weather; i.e. curbs, sidewalks, 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.

- G. 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 or plumbing piping.
- 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.
- D. Place joint filler at perimeter of floor slab.

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. Lap joints minimum 6 inches and seal watertight. Repair damaged vapor barrier with vapor barrier material; lap over damaged areas minimum 6 inches and seal watertight. Place sheeting in position with longest dimension parallel with direction of pour.
- C. Separate interior slabs-on-grade from vertical surfaces, 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. Concrete shall be conveyed from the mixer to place of final deposit by methods which will prevent separation and loss of material.
- G. 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°F.
- H. 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.
- I. 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.
- J. 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.
- K. 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.
- L. Place floor slabs in checkerboard or saw cut pattern indicated. Refer to structural drawings for design of

construction and control joints. In all cases, spacing of control joints shall not exceed areas of 1,000 s.f.

- 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. Walks, slabs shall be 4" thick unreinforced, unless otherwise shown. Curbs shall be reinforced with bars; other items shall be reinforced as detailed. All parts shall be one-course monolithic construction between joints. Form walks with vertical curves at points where change in grade exceeds 2%, elsewhere as shown. Side form all work. Slope or crown top surfaces of walks, 1/4" per foot to low side or as directed by Architect/Engineer.
- P. Protecting and sealing: Protect concrete walks, curbs, 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.

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. Maintain surface flatness, with maximum variation of 1/8 inch in 10 ft.
- 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. 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 306.
 - 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.
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 FIELD QUALITY CONTROL

- A. Inspection and testing shall be performed by firm approved by Architect/Engineer. Firm shall be an independent testing lab as selected by the Architect/Engineer in accordance with Division 1, Section 01410.
- 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 01410.
- 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, 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 Architect by Testing Laboratory, with all required information shown.

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- 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.

3.09 DEFECTIVE CONCRETE

- A. Modify or replace concrete not conforming to required lines, details and elevations, as directed by Architect/Engineer.

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.

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 work (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 "Plastiment."
2. Euclid Chemical Co. "Delaz".

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 walls and all exterior masonry work below grade; ASTM C270, Type 'S', using the property method unless noted otherwise on structural drawings. Use ASTM C270 Type 'N' at exterior veneers.
- B. Pointing mortar for masonry ASTM C270, Type 'N', using the property method.
- C. 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.
- D. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for, and approved by manufacturer of, structural clay tile facing units; in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.
- E. 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. 2500 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.
- 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.

- B. Related work specified elsewhere:

- 1. Section 04100 - Mortar & grout.

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 = 1500 psi (10.3 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 including proposed reinforcing.

- 1. Weep holes/vents in color to match mortar color.
 - 2. 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.

- B. 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.
- C. 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.
- D. Scored/Split/Smooth/Striated Concrete Masonry Units:
 - 1. Units shall be medium weight block (105-125 PCF). Units shall meet or exceed requirements of ASTM C-90.
 - 2. Units shall be integrally colored with colors as selected by Architect from manufacturer's standard available colors including white aggregate. All pre-colored block shall be in accordance with the Standards of the Concrete Masonry Association.
 - 3. All exterior above grade units exposed to moisture shall be fabricated with integral water repellent additive meeting ASTM E-514.
 - 4. Provide scored units, smooth units and split face units in locations indicated on plans and elevations.

2.02 REINFORCEMENT AND ANCHORAGE

- A. 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.
- B. 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.
- C. Manufacturers:

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1. AA Wire Products Co.
2. Dur-O-Wal.
3. National Wire.
4. Hohmann and Barnard, Inc.
5. Other Architect Approved.

- D. Reinforcing Steel: ASTM A615, 60-ksi-yield grade deformed steel bars unprotected finish.

2.03 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.

2.04 ACCESSORIES

- A. Building Paper: 15# asphalt saturated felt.
- B. 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.
- C. 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.

2.05 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 indicated to match range and blend of existing building.
 - 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 masonry walls which enclose storage rooms, 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.
- F. 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.
- G. 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.
- H. 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.
- I. Construct bond beams as indicated with concrete grout. Maintain accurate location of reinforcing steel during grout placement.
- J. Grout course solid (or use solid units) immediately below veneer, where masonry serves as support for the veneer (i.e. brick ledges).
- K. 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 32 inches 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 - 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.

3.07 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.

3.08 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.

3.09 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.

3.10 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.

3.11 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.
- 3.12 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.
- 3.13 POINTING AND CLEANING
- A. Point up all exposed existing brick where required, fill all holes and joints; remove loose mortar, cut out defective joints, and repoint where necessary.
- 3.14 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.
- 3.15 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.

3.16 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" 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.

3.17 MASONRY WASTE DISPOSAL

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

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END OF SECTION 04300

SECTION 05120 - STRUCTURAL STEEL

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 structural steel framing members, accessories, and assemblies scheduled on the drawings and/or herein. Section also includes architecturally exposed structural steel.
- B. Furnishing, erection and removal of temporary bracing and erection material for complete job safety.
- C. Items to be furnished under this Section include structural steel framing, beams, and associated angles, plates, clips, brackets, and bars. Provide anchor bolts and loose lintels for setting by others. Provide miscellaneous plates, base plates, bearing plates, and grouting.
- D. Related work specified elsewhere:
 - 1. Section 04300 - Unit Masonry (placement of anchors for embedding into masonry).

1.03 SUBMITTALS

- A. Shop Drawing: Indicate sizes, spacing, dimensions and locations of structural members, openings, connections, cambers, loads and welded connections.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

- B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.
- C. Fabricate structural steel members in accordance with AISC-Specification for the design, fabrication and erection of structural steel for buildings.
- D. "Code of Standard Practice for Steel Buildings and Bridges" adopted by the American Institute of Steel Construction, AISC.
- E. "Code for Welding in Building Construction", of American Welding Society AWS D1.1. The term, Building Commissioner, as used in this code shall mean Authorized Engineer. Use AWS certified welders for welding processes involved.
- F. "Specification for Structural Joints Using ASTM A325 Bolts or A490 Bolts", approved by Research Council on structural connections of the engineering foundation.
- G. Surface preparation and paint application specifications of the Steel Structures Painting Council (SSPC).
- H. Standard specification of the American Society of Testing Materials (ASTM), as designated herein.
- I. Load indicator washer, if used, shall conform to the latest edition of ASTM Specification or high strength bolting, ASTM Designation A-325.
- J. Manufacturer's specifications, directions, instructions, and when referred to, governing regulations furnished by the Architect/Engineer, before any work has begun.

PART 2. PRODUCTS

2.01 MATERIALS

- A. Structural Steel Members (Rolled Shapes): ASTM A992, $F_y=50\text{ksi}$.
- B. Plates/Bars/Etc.: ASTM A36, $F_y=36\text{ksi}$.
- C. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide.

2.02 FABRICATION

- A. Continuously seal joined members by continuous welds. Grind exposed welds smooth.
- B. Fabricate in accordance with above standards and normal fabrication practice to achieve components capable of being erected into complete, safe, well-constructed structure within minimum tolerances specified. Steel shall be free from scale, pits, rust. Steel shapes other than indicated may be substituted if no change in architectural design is involved; substitutes must develop strength and stiffness of indicated shapes. Architect/Engineer shall not permit use of steel bearing trademarks and names that will remain legible after application of final finish product for exposed work.
- C. Provision for Other Trades: Provide all lugs, clips, connections, bolts, studs, holes, etc., necessary to complete fabrication, erection, and attachment of materials for other trades. Responsibility for providing information relating to such material, holes, shall be provided in time for inclusion on shop drawings by trade involved.
- D. Loose Bearing Plates: Provide loose bearing plates for all beams bearing on masonry surfaces, except as otherwise shown on drawings.
- E. Exposed Steel: Exposed member shall be absolutely straight, with surface smooth, corners, edges sharp, true and free from burrs, other irregularities. Overruns, adjacent members perfectly matched. Exposed welds shall be neatly dressed, ground smooth. Exterior walls shall be smooth, continuous, watertight. Exposed steel surfaces shall be free from rolled or stamped heat numbers, manufacturer's names, other identification marks.
- F. Erection Material: Provide all lugs, connections, anchors, shims, filler plates, rods, bolts, etc., necessary for complete erection, for complete job safety.

2.03 FINISH

- A. Shop Paint: Clean surfaces thoroughly according to SSPC-SP2 "Hand Cleaning", if necessary, SSPC-SP3 "Power Tool Cleaning", to remove all rust, scale. Apply one shop coat of paint in accordance with SSPC-15, at manufacturer's recommended rate, brushed or sprayed to achieve 1.5 mil dry film thickness. Painting of exposed steel shall be in strict accordance with manufacturer's printed specifications, methods and recommendations. Do not paint surfaces within 2" of field welds. Take particular care to provide paint film

on exposed members that is smooth, even, free from runs, drips, other visual defects.

- B. Shop prime structural steel members.

PART 3. EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Inspection: Prior to commencing work, verify all steel locations, grouting, elevation of leveling and bearing plates, related work set by others, report discrepancies for correction. Field measurements, where required, shall be taken by this trade, who shall be responsible for their accuracy.

3.02 ERECTION

- A. Delivery and Storage: Exercise care in unloading and storage to avoid damage. Dumping to ground shall not be permitted. Material stored at site shall be supported completely free of ground, covered to avoid damage from elements. Members warped or bent shall be unacceptable; and shall be replaced if, in Architect/Engineer's opinion, they are unserviceable or cannot be corrected within fabrication tolerances. Provide proper shakeout area for all steel to prevent damage.
- B. Allow for erection loads. Provide temporary bracing to maintain framing in alignment until completion of erection and installation of permanent bridging and bracing.
- C. Field weld components indicated on Drawings and shop drawings.
- D. Do not field cut or alter structural members without approval of Architect/Engineer.
- E. Erection Procedure: Erect material plumb, level, maintain condition to completion. Take particular care to have work plumb and level before making permanent connections. Tolerance shall be 1 to 500 for interior members; 1 to 1000 for exterior and exposed members. Connect members temporarily, align complete before making permanent connections. Temporary connections shall consist of installation of minimum of 1/3 of bolts with minimum of 2 bolts per connection. Provide necessary temporary bracing and guying, to align structure properly for permanent

connections, to safely resist all erection, dead and wind load. Remove bracing and guys, only after completion of permanent alignment, assembly, and when structure is capable of completely sustaining design and temporary construction loads.

F. Bearing Plates:

1. Setting Bearing Plates: Clean masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.
2. Set loose bearing plates for structural members on grout pad.
3. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
4. For proprietary grout materials, comply with manufacturer's instructions.

3.03 FIELD QUALITY CONTROL

- A. Field inspection will be performed under provisions of Division 1, General Requirement.
- B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.
- C. Additional testing, at contractor's expense, will be performed to determine compliance of corrected work with specified requirements.
- D. Field-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts".
- E. In addition to visual inspection, field-welded connections may be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.
 1. Liquid penetrant inspection: ASTM E165.
 2. Magnetic particle inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 3. Radiographic inspection: ASTM E94 and ASTM E142; minimum quality level "2-2T".
 4. Ultrasonic inspection: ASTM E164.

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SECTION 05400 - COLD-FORMED METAL FRAMING

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 all load and non-load bearing exterior structural steel studs and joist framing, fasteners and accessories. Refer to Section 09260 for lightweight, furring and framing.
- B. Related work specified elsewhere:
 - 1. Section 06100 - Rough Carpentry
 - 2. Section 09250 - Gypsum Drywall

1.03 SYSTEM DESCRIPTION

- A. Size components to withstand design live and dead loads per design drawings or as follows:
 - 1. Vertical Assembly: Exterior, 20 PSF positive or negative; Interior 5 PSF positive or negative.
 - 2. Horizontal Assembly: 20 PSF live load.
- B. Maximum allowable deflection: Per design drawings or 1/360 of span.
- C. Design wall system to provide for movement of components without damage. Contribution from sheathing shall not be considered for lateral deflection.
- D. Design system to accommodate construction tolerances, deflection of building structural members, including metal deck and clearances of intended openings.

1.04 SUBMITTALS

- A. Shop Drawings: Indicate component details, framed openings, bearing required, loading, welds, type and location of fasteners and describe framing connections.
- B. Provide stud layout. Provide calculations for loading, deflection, and stresses of framing.
- C. Product Data: Describe materials and finish, product criteria, and limitations.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this project and with a record of successful in-service performance.
- B. AISI - American Iron and Steel Institute, Cold-Formed Steel Design Manual.
- C. ASTM A446 - Steel Sheet, Zinc Coated (Galvanized) by Hot-Dip Process, Physical (Structural) Quality.
- D. ASTM A525 - Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process.
- E. ASTM A570 - Hot-Rolled Carbon Steel Sheet and Strip Structural Quality.
- F. ASTM A611 - Steel, Cold-Rolled Sheet, Carbon, Structural.
- G. ASTM C955 - Load Bearing (Transverse and Axial) Steel Studs, Runners (Track) and Bracing or Bridging, for Screw Application of Gypsum Board and Metal Plaster Bases.
- H. AWCI (Association of Wall & Ceiling Industries) - Specification Guide for Cold-Formed Structural Members.
- I. AWS D1.1 - Structural Welding Code - steel.

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- J. AWS D1.3 - Structural welding code - sheet steel.
- K. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.
- L. MFMA (Metal Framing Manufacturers Association) - Guidelines for the Use of Metal Framing.

PART 2. PRODUCTS

2.01 FRAMING MATERIALS

A. Manufacturers

- 1. Unimast Incorporated
- 2. Clark Steel Framing
- 3. Dale/Incor
- 4. Marino/Ware
- 5. Dietrich Industries, Inc.

B. Studs: ASTM A446, sheet steel 'C' channel shape, solid web, minimum 18-gage, size as noted on drawings, galvanized to G-60 coating class. Yield strength of 33,000 psi minimum. 25-gage studs are acceptable for interior applications.

C. Stud Track: Formed steel, channel shaped; same width and gage as stud, solid web, galvanized to G-60 coating class.

2.02 ACCESSORIES

A. Bracing, Furring, Bridging, Plates, Gussets, Kickers, Stiffeners, Clips: Formed steel, thickness, same as stud or determined for conditions encountered; same finish as framing members.

B. Screws: ASTM A123, hot dip galvanized to 1.25-oz./sq. ft., self-drilling, self-tapping.

C. Anchorage Devices: Power driven, power actuated or drilled expansion joint as required relative to substrata.

D. Welding: In accordance with AWS D1.1 or D1.3.

- E. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 with dry film containing minimum of 94 percent zinc dust by weight.

2.03 FABRICATION

- A. Fabricate assemblies of sizes and profiles required; with framing members fitted, reinforced and braced.
- B. Fit and assemble in largest practical sections for delivery to site, ready for installation.
- C. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or distortion.

PART 3. EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Verify that substrate surfaces and building framing components are ready to receive work.
- B. Beginning of installation means acceptance of existing conditions and substrate.

3.02 ERECTION OF STUDDING

- A. Install components in accordance with manufacturer's instructions.
- B. Align top and bottom tracks; locate to wall layout. Secure with fasteners at maximum 24-inches o.c.
- C. Place studs at 16-inches o.c. unless noted otherwise on drawings; not more than 2-inches from abutting walls and at each side of openings. Connect studs to tracks using fastener method. Wire tying of framing members is not permitted.
- D. Construct corners using minimum three studs. Double stud each wall opening, door, and window jamb. Install intermediate studs above and below openings to match wall stud spacing.

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- E. Erect load bearing studs one-piece full length. Splicing of studs is not permitted.
- F. Allow for deflection, directly below horizontal building framing, metal decking, etc., for non-load bearing framing.
- G. Attach cross studs and furring channels to studs for attachment of fixtures anchored to walls and for attachment of mechanical and electrical items within walls.
- H. Touch-up field welds and damaged prefinished surfaces with primer.
- I. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.
- J. Coordinate installation of all wood blocking for installation of items supplied by other trades.
- K. Coordinate installation of all framing to accommodate openings required by architectural, mechanical and electrical trades.

3.03 TOLERANCES

- A. Maximum variation from true position: 1/4-inch.
- B. Maximum variation of any member from plane: 1/4 inch.

END OF SECTION 05400

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.
- B. Related work specified elsewhere:
 - 1. Section 05120 - Structural Steel, including all angles, beams, columns, bolts, etc., shown on the structural drawings or required by the architectural drawings.

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 Owner'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.

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. For exterior installations and were indicated, provide

members with hot-dip galvanizing coated per ASTM A53.

4. 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 Themec Primer" or "Rustoleum Number 5769 Primer".

- 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.

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'-6'' span: One 3'' x 3-1/2'' x 5/16'' steel angle supporting each 4'' thick module of masonry.
 - b. Spans 4'-6'' 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. Galvanized loose steel lintels to be installed in exterior walls.

D. 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. Galvanized exterior miscellaneous frames and supports.

PART 3. EXECUTION

3.01 SURFACE CONDITIONS

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- 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 Standard PS 1, "Softwood Plywood/Construct and Industrial" except as otherwise indicated.
- B. Factory mark each piece of lumber and plywood with type, grade, mill, and grading agency.

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, 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 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 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 American Plywood 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 Bureau (AWPB).
- B. Pressure-treat above-ground items with water-borne preservatives complying with AWPB LP-2. After treatment, kiln-dry to a maximum moisture content of 15%. 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 Constructor, 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 the American Plywood 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-beveled 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 "Manual for House Framing" of National Forest Products Association. Do not splice structural members between supports.

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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 American Plywood
Association (APA) for the installation of plywood.
2. Sheathing and Subflooring: Install as recommended by
the APA's "Guide to Plywood Sheathing for Floors,
Walls, and Roofs" for the spacing of supports or types
of substrates involved in the work.

END OF SECTION 06100

SECTION 06402 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1RELATED DOCUMENTS

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

1.2SUMMARY

- A. This Section includes the following:
 - 1. Interior standing and running trim and rails.
 - 2. Laminate clad cabinets (plastic-covered casework).
(Unless scheduled as pre-manufactured in casework legend on drawings). Includes custom detailed desks and counters.
 - 3. Cabinet tops (countertops).
 - 4. Interior miscellaneous ornamental items.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 6 Section "Rough Carpentry" for furring, blocking, and other carpentry work that is not exposed to view.
 - 2. Division 8 Section "Flush Wood Doors" for doors specified by reference to architectural woodwork standards.
 - 3. Division 9 Section "Painting" for final finishing of installed architectural woodwork.
 - 4. Division 12, Furnishings specifies built-in classroom equipment.

1.3SUBMITTALS

- 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.

1.4QUALITY 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.
- F. Hardware Coordination: Distribute copies of approved scheduled for cabinet hardware specified in Division 8 Section "Finish Hardware" to manufacturer of architectural woodwork; coordinate cabinet shop drawings and fabrication with hardware requirements.

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 of one of the following:
1. Formica Corp.
 2. Laminart.
 3. Micarta Div., Westinghouse Electric Corp.
 4. Nevamar Corp.
 5. Wilsonart International
 6. Sterling Engineered Products, Inc.

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.
 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, 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 AWPAC20.
- 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 AND RAILS FOR TRANSPARENT FINISH

- 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: Custom.
- 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 AND RAILS 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 WOOD CABINETS (CASEWORK) FOR TRANSPARENT FINISH

- A. Quality Standard: Comply with AWI Section 400 and its Division 400A "Wood Cabinets."
- B. Grade: Custom.
- C. AWI Type of Cabinet Construction: Flush without exposed face frame.
- D. Wood Species for Exposed Surfaces:
 - 1. Red oak, rift sawn/cut.

2. Provide Wilsonart brand decorative tambours. Pattern S109 solid red oak, product #810.
- E. Wood Species for Exposed Surfaces: As indicated.
 1. Grain Matching: As indicated.
 2. Comply with veneer and other matching requirements indicated for blueprint-matched paneling.
- F. Wood Species for Semiexposed Surfaces: Match species and cut indicated for exposed surfaces.
- G. Provide dust panels of 1/4-inch plywood or tempered hardboard above compartments and drawers except where located directly under tops.

2.8 WOOD CABINETS (CASEWORK) FOR OPAQUE FINISH

- A. Quality Standard: AWI Section 400 and its Division 400A "Wood Cabinets."
- B. Grade: Custom.
- C. Species for Exposed Lumber Surfaces: Any close-grained hardwood listed in referenced woodworking standard.
- D. Panel Product for Exposed Surfaces: Medium density fiberboard.
- E. Materials for Semiexposed Surfaces: Match materials indicated for exposed surfaces.
- F. Provide dust panels of 1/4-inch plywood or tempered hardboard above compartments and drawers except where located directly under tops.

2.9 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:

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.

2.10 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. Hardware:
 1. Shelf Standards: Knappe & Vogt #255. Shelf Clips: Knappe & Vogt #256.

2. Cable Hole Covers: High impact ABS cable hole cover, 2 ½ inch inside diameter, with spring closure in tip. Color as selected by Architect. Refer to Drawings for locations. Manufactured by Hafele.
 - 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.
- 2.11 ARCHITECTURAL CABINET TOPS (COUNTERTOPS and BACKSPLASHES)
- A. Quality Standard: Comply with AWI Section 400 and its Division 400C.
 - B. Type of Top: High pressure decorative laminate complying with the following:
 1. Grade: Custom.
 2. Laminate Cladding for Horizontal Surface: High pressure decorative laminate as follows:

- a. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

- 1) Match Architect's sample.

- 3. Edge Treatment: 3MM edge in color to be selected.

- C. Fire Performance Characteristics: Provide paneling composed of panels of wood veneer density and fire-retardant particleboard that are identical in construction to units tested for the following surface burning characteristics per ASTM E 84 by UL or other testing and inspecting organization acceptable to authorities having jurisdiction. Identify panels with appropriate markings of applicable testing and inspecting organization on surfaces that will be concealed from view after installation.

- 1. Flame Spread: 75 or less.
 - 2. Smoke Developed: 40 or less.

2.12 INTERIOR MISCELLANEOUS ORNAMENTAL ITEMS FOR TRANSPARENT FINISH

- A. Quality Standard: Comply with AWI Section 700.

2.13 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.

2.14 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.

2.15 FACTORY FINISHING OF INTERIOR ARCHITECTURAL WOODWORK

- A. Quality Standard: Comply with AWI Section 1500 unless otherwise indicated.
- B. General: The primary and prefinishing (if any) of interior architectural woodwork required to be performed at factory is specified in this section. Refer to Division 9 Section "Painting" for final finishing of installed architectural woodwork and for material and application requirements of prime coats for woodwork not specified to receive final finish in this section.
- C. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces and similar preparations for finishing of architectural woodwork, as applicable to each unit of work.
- D. Transparent Finish for Open-Grain Woods: Comply with requirements indicated below for grade, finish system, staining, effect, and sheen, with sheen measured on 60 deg gloss meter per ASTM D 523.
 - 1. Grade: Custom.
 - 2. AWI Finish System #1: Standard lacquer.
 - 3. Staining: Match Architect's sample.
 - 4. Effect: Closed grain (filled finish).
 - 5. Sheen: Medium-gloss rubbed effect 35-45 deg.
- E. Transparent Finish for Closed-Grain Woods: Comply with requirements indicated below for grade, finish system, staining, effect, and sheen.
 - 1. Grade: Custom.
 - 2. AWI Finish System #1: Standard lacquer.
 - 3. Staining: Match Architect's sample.

4. Effect: Closed grain.
 5. Sheen: Medium-gloss rubbed effect 35-45 deg.
- F. Opaque Finish: Comply with requirements indicated below for grade, finish system, color, effect, and sheen:
1. Grade: Custom.
 2. AWI Finish System #9: Standard lacquer.
 3. Color: Match Architect's sample.
 4. Sheen: Medium-gloss rubbed effect 35-45 deg.

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.

3.3ADJUSTMENT 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.

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3.4PROTECTION

- 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.

END OF SECTION 06402

SECTION 07600 - FLASHING AND SHEET METAL

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. Gravel stops
- B. Counterflashings and reglets
- C. Expansion joint covers
- D. Copings

1.02 RELATED WORK:

- A. Section 06100 - Preservative-treated wood blocking for roof edge and gravel stop.
- B. Section 04300 - Masonry: For flashing in masonry walls.
- C. Roofing accessories installed integral with roofing membrane are specified in roofing system sections as roofing work.
- D. Curbs for roof mounted heating and ventilating equipment are included in the Work of Division 15.

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 Owner's Representative.
- B. Shop Drawings and color samples will be required for gravel stops in accordance with the General Conditions and Supplementary General Conditions. 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 GUARANTEE:

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.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. The type and locations of the various kinds, gauges, thickness, and finish of sheet metal to be used is specified hereinafter under the individual items. Where sheet metal is indicated on Drawings and kind or type of metal is not definitely specified, galvanized steel shall be provided.
- B. Galvanized sheet metal shall be commercial quality with 0.20 percent copper, ASTM A525 except ASTM A527 for lock forming; G90 hot dip galvanized, mill phosphatized where indicated for painting; 20 gauge thick except as otherwise indicated.

2.02 MISCELLANEOUS MATERIALS AND ACCESSORIES:

- A. Solder: Shall conform to ASTM B32066T. Composition shall contain 50 percent tin and 50 percent lead, except as specified otherwise. Solder for aluminum and monel shall be of composition as recommended by the metal manufacturer.
- B. Bituminous Coating: SSPC-Paint 12, solvent type bituminous mastic, nominally free of sulfur, compounded for 15 mil dry film thickness per coat.
- C. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.
- D. Elastomeric Sealant: Generic type recommended by manufacturer of metal and fabricator of components being sealed and complying with requirements for joint sealants as specified in Specification Section 07920 - Joint Sealants.
- E. Epoxy Seam Sealer: 2 part noncorrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior nonmoving joints including riveted joints.
- F. Metal Accessories: Provide sheet metal dips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gauge required for performance.
- G. Roofing Cement: ASTM D2822, asphaltic.

2.03 PREFABRICATED REGLETS AND COUNTERFLASHING

- A. Prefabricated Reglets and Counterflashings: Equal to "Fry Springlok Flashing System"; Fry Reglet Corporation, Alhambra, CA, made of 24 gauge galvanized steel. Reglet shall have a 2 inch factory-formed end lap; flashing shall have a 3 inch end lap. Provide factory manufactured mitered and sealed corners.
 - 1. Surface mounted for use with concrete or masonry substrate, unless indicated otherwise. Factory punched slots shall be located on 12 inch centers and all for expansion. System requires sealant at time of installation. Refer to Specification Section 07920 - Joint Sealants.
 - a. Product: Type SM - Surface Mounted (Expan-O-Seal)
 - b. Product: CFW2-500 - Surface Mounted Counter Flashing
 - 2. For use with masonry, where indicated provide reglet with a 4 inch wide top flange.
 - a. Product: Type MA-4 - Masonry
 - b. Product: CFR2-500 - Reglet Counter Flashing

2.04 FLEXIBLE EXPANSION JOINT COVER

- A. Provide units consisting of exposed elastic sheet over foam bellows, securely anchored at both edges to 3 to 4 inches wide sheet metal nailing flanges, formed to fit curbs as required. Bellows insulated from below with adhesively applied, closed cell, flexible, rubber or plastic insulation not less than 5/16 inches thick, adhered to elastic sheet.
 - 1. Flexible Sheet: Neoprene 60 mils.
 - 2. Flexible Sheet Width: 5 to 6 inches between flanges.
 - 3. Metal Flanges
 - a. Zinc-coated (galvanized) steel, 28 gauge.
 - b. Where flanges are indicated for embedment in concrete or mortar, provide manufacturer's standard perforated mortar flanges.
- B. Products: Subject to compliance with requirements, provide one of the following:
 - 1. "Expansion Joint Shield"; Celotex Corporation
 - 2. "Metalastic"; International Permalite, Inc.
 - 3. "Expand-O-Flash"; Manville Sales Corp.

2.05 PREFABRICATED COPING

- A. Interlocking Multi-Part Coping System: Manufacturer's standard system consisting of coping formed from 20 or 24 gauge galvanized sheet to profile and thickness indicated, minimum 20 gauge, zinc-coated steel anchor plate or cleat located at coping joint, and formed aluminum gutter chair or gutter/splice plate or compression pad/gutter; with prefabricated inside and outside corners, miters welded before finishing; without exposed fasteners.
1. Products: Subject to compliance with requirements, include one of the following:
- a. "Permasnap Coping"; Hickman, Asheville, North Carolina
 - b. "Perma-Tite Coping"; Metal-Era, Waukesha, Wisconsin
 - c. "Snap-Lock Coping"; MM Systems Corp., Tucker, Georgia

2.06 FINISHES

- A. General: Apply coatings either before or after forming and fabricating panels, as required by coating process and as required for maximum coating performance capability. Protect coating either by application of strippable film or by packing plastic film or other suitable material between panels in a manner to properly protect the finish. Furnish air drying spray finish in matching color for touch-up.
1. Provide colors or color matches as indicated or, if not indicated, as selected by Architect from manufacturer's standard colors.
- B. High Performance Coating: AA-C12C42R1x. Apply in strict compliance with coating and resin manufacturer's instructions using a licensed applicator.
1. Fluoropolymer Coating: Manufacturer's standard two-coat, thermocured, full strength 70 percent "Kynar 500" coating consisting of a primer and a minimum of 0.75 mil dry film thickness with a total minimum dry film thickness of 0.9 mil and 30 percent reflective gloss when tested in accordance with ASTM D523.

2.07 FABRICATION

- A. General: Shop fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.
- B. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. For metal other than aluminum, fin edges to be seamed, form seams and solder. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.
- C. Expansion Provision: Where lapped or bayonet-type expansion provisions in work cannot be used or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- D. Sealant Joints: Where movable, nonexpansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.
- E. Separations: Provide for separation of metal from noncompatible metal or corrosive substrates by coating or other permanent separation as recommended by manufacturer/fabricator.
- F. Shop/field fabricate galvanized sheet metal and flashings shall be fabricated to configurations indicated on the drawings.
 - 1. Fabricate from 20 or 24 gauge galvanized sheet metal, unless otherwise noted or required to meet SMACNA recommended minimum gauge, with factory applied finish as specified.
 - a. Use 20 gauge steel when face is wider than 6 inches to prevent "oil-canning or sagging".
 - b. Provide vented closure pieces where indicated.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations and with SMACNA "Architectural Steel Metal Manual".
- B. Install work with provisions for thermal expansion of flashings, gravel stops, coping, fascia and other items exposed for more than 15 feet continuous length. Maintain a watertight installation at expansion seams. Locate expansion seams where shown, or if not shown, in conformance with applicable recommendations of "Architectural Sheet Metal Manual" by SMACNA.
- C. Sheet metal work shall be watertight and weathertight; lines, arrises, and angles sharp and true; plain surfaces free from waves and buckles. Workmen shall be experienced in the trade and thoroughly capable of performing the Work in accordance with these requirements.
- D. Prefabricated reglets and counterflashings shall be installed in accordance with manufacturer's printed instructions. Coordinate reglets with work by others.
 - 1. Surface mounted system shall include sealant as follows:
 - a. Apply continuous bead of sealant or plastic cement to back of type "SM" or "CFR2" reglet.
 - b. Install Type "SM" or "CFR2" reglet on surface of flexible flashing on wall parallel to roof slope with fasteners furnished by manufacturer. Fill top groove with sealant and tool tight against wall with surface of sealant sloping to outside.
 - 2. Position counterflashing into reglet and "snap" into place against roof membrane flashing.
 - 3. Reglet shall be installed at least 8 inches above high point of roof membrane.
- E. Roofing Expansion Joints: Installation shall be in accordance with the manufacturer's written instructions and as indicated. Nail flanges of expansion joint units to curb nailers, at maximum spacing of 6 inches o.c. Fabricate seams at joints between units with minimum 3 inch overlap, to form a continuous waterproof system.

F. Prefabricated Coping

1. Install as recommended by manufacturer and as indicated.
2. Provide splice plates, cover plates and other items necessary for complete installation.
3. Install according to best standard practices, with continuous hold down clips at 36'' on center.
4. Provide expansion and slip joints every 20 feet of straight length and joints with appropriate sealant of matching color.

G. Flashing at Roof Penetrations (Miscellaneous)

1. Work under this Section shall include the flashing of roof penetrations not otherwise specified under other Sections.
2. Flashing of roof penetrations not detailed shall be performed according to the recommendations and specifications of the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA), subject to approval by the Architect.

3.02 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces in accordance with manufacturer's instructions. Touch-up damaged metal coatings.
- B. Protection: Provide protective measures as required to ensure that work of this Section will be without damage or deterioration at time of Substantial Completion.

END OF SECTION 07600

SECTION 07610 - STANDING SEAM METAL ROOFING SYSTEM

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.
- B. Furnish and install roofing panels, fasteners, clips, downspouts, flashings, closures, insulation, snow guards, ice and water shield, vapor barrier, sheathing, gutters and miscellaneous accessories required to complete the roofing enclosure as indicated on the contract drawings.

1.02 DESCRIPTION OF WORK:

- A. The extent of the standing seam metal roofing system is shown on the drawings.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

- A. Structural Steel Section 05120

1.04 QUALITY ASSURANCE:

A. Manufacturer Qualifications:

- 1. The manufacturer shall have had at least fifteen (15) years experience in architectural roofing design and installation. The manufacturer shall have a permanent, stationary, indoor production facility.
- 2. The manufacturer shall submit the names and addresses of five (5) previous standing seam metal roofing projects of comparable size, scope, and complexity.

B. Installer Qualifications:

- 1. The installer shall have had a minimum of five (5) years experience in the installation of metal roofing.
- 2. The installer shall submit the names and addresses of five (5) previous standing seam metal roofing projects of comparable size, scope, and complexity.

1.05 REFERENCE LATEST EDITIONS OF PUBLICATIONS AND STANDARDS

A. Building Design Codes — Uplift, Live and Dead Loads

1. ASCE Standards, Minimum Loads for Buildings and Other Structures, American Society of Civil Engineers (ASCE).
2. International Building Code as amended by the State of Michigan.
3. N.F.P.A.

B. Reference Standards

1. American Iron and Steel Institute (AISI). Specification for the Design of Cold-Formed Steel Structural Members (Aug. 1986).
2. American Institute of Steel Construction (AISC) Manual of Steel Construction (Current Edition).
3. American Society for Testing and Materials (ASTM) (Current Edition).
 - a. E 1592, ``Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference``.
 - b. A 653 standard specification for steel sheet, zinc-coated (galvanized) by the hot-dip process.
 - c. E 1680 Test for Rate of Air Leakage through Exterior Metal Roof Panel Systems.
 - d. E 1646 Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.

4. Factory Mutual

C. Underwriters Laboratories (UL)

1. Building Materials Directory (current issue).
2. Fire Resistance Directory (current issue).

1.06 SUBMITTALS

A. Provide the following upon request of the Architect.

1. Submit the following test reports, certified by an independent testing laboratory or an independent professional engineer, to verify that the proposed roofing will meet performance requirements of this specification.
 - a. Thermal Cycle Test.
 - b. ASTM E 1592, ``Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference'' test results.
 - c. Clip Fastener Pull-Out Tests and Calculations.
 - d. UL 580 Class 90 Test Data.
 - e. FM approval Std. 4471 for Class 1 Panel Roofs.
 - f. Concentrated Load Test Data.
 - g. Air Infiltration (E 1680) and Water Penetration E 1646) Test Results.
 - h. Coating Performance Testing.
2. A certified statement from the manufacturer attesting to a minimum of fifteen (15) years experience with roofing systems.
3. A letter from the manufacturer listing installers that are qualified to erect the manufacturer's material.
4. A letter from the installer per QUALITY ASSURANCE.

B. With the proposal:

1. Qualifications and/or exceptions to the drawings and specifications.

C. Prior to fabrication:

1. Shop drawings consisting of catalog cuts, design and erection drawings, finish specifications, and other data necessary to clearly describe design, materials, sizes, layouts, construction details, fasteners, and

erection. Submit small scale layouts of panels and large scale details of edge conditions, joints, fastener and sealant placement, flashings, penetrations and curbs, and special details. Distinction must be made between factory and field assembly work. Drawings must be approved before fabrication can begin.

2. Erection procedures and instructions submitted with drawings.
 3. Performance Requirements — Submit structural design calculations and test reports certified by a registered professional engineer to verify load-carrying capacities of panel system, fasteners, and expansion control calculations.
 4. Furnish certified laboratory test reports showing that the specified system has been tested and conforms to applicable provisions specified herein.
 5. Certification by the manufacturer that the roofing assembly has been successfully tested under both UL 580 & FM procedures and has achieved a Class 90 rating.
 6. Samples and descriptive data:
 - a. Roof panel: Full panel width, 12 inches (305 mm) long.
 - b. Anchor clips: Two required.
 - c. Fasteners: Two of each type to be used, with a statement regarding intended use.
 - d. Closures: One metal closure with foam filler.
 - e. Insulation: 12 inches (305 mm) square, full thickness.
 - f. Sealant: One sample of each sealant, with a statement regarding intended use.
- D. Design wind loads are as follows:
- | | |
|---------|--------|
| Field | 14 psf |
| Ridge | 18 psf |
| Eave | 18 psf |
| Corners | 22 psf |

1.07 WARRANTY

- A. Provide a minimum 10 year manufacturer warranty for material and installation of entire standing seam roof system.
- B. Finish warranties shall be the paint manufacturer's standard 20 year warranty.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Basis of Design to be the CENTRIA SRS 3 Mechanically Seamed Standing Seam Roof System as manufactured by CENTRIA, 1005 Beaver Grade Road, Moon Township, Pennsylvania 15108-2944.
 - 1. Other manufacturers - Bemo Corp.= www.bemo.com. Zip Rib = www.ziprib.com
- B. Certified installers to be:
 - 1. Crown Corr Inc. 734-782-4841
 - 2. C.L. Rieckhoff 734-946-8220 X103
 - 3. Stephenson Corp. 810-742-2055
- C. Requests to use alternate systems must be submitted in writing to the project designer at least ten (10) days prior to the bid date. Performance requirements, certified statements, samples, and descriptive data must be included in this submittal per Part 1 of this specification, for designer review and approval.
- D. Manufacturers listed in this section are pre-qualified manufacturers. Substitution of other manufacturers product for those specified will not be allowed at any time during bidding or construction.
- B. Being listed a pre-qualified manufacturer does not release the manufacturer from providing complete and acceptable windload, thermal, and other performance data.

2.02 PRODUCT PERFORMANCE:

- A. Tests shall have been conducted or witnessed by a recognized independent laboratory or independent professional engineer.

- B. The standing seam panel system shall be designed to safely resist the positive and negative loads of the roofing system.
- C. Structural-uniform uplift load capacity of the panel system shall be determined in accordance with test procedures defined in ASTM E 1592, "Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference" as follows:
 - 1. The Factor of Safety on the test results shall be 1.65 for the panel, batten or clip ultimate loads, with no increase for wind.
 - 2. The Factor of Safety for fasteners shall be 3.0 for one single fastener per clip, 2.25 for two fasteners per clip and 4.0 in masonry.
 - a. Design uplift capacity for conditions of gage, span or loading other than those tested may be determined by interpolation of test results. Extrapolation of conditions outside the range of the tests is not acceptable.
 - b. Deflection shall be $L/180$ for positive loading.
- D. Water penetration of the panel side joint at 20 psf. (.96 kPa) pressure for 15 minutes shall be "no uncontrollable leakage" when tested in accordance with ASTM Test Procedure 1646.
- E. Air infiltration of the panel side joint at 20 psf (.96 kPa) pressure shall be no more than 0.0156 cfm/ft² (0.079 L/s/m²) of panel when tested in accordance with ASTM Test Procedure E 1680.
- C. Panels shall be thermal cycle tested a minimum of 100,000 cycles with a minimum of two (2) inches (50 mm) of movement relative to the clip anchor. Panels and clips shall show that the wear will not affect structural performance or weathertightness of the system.
- D. The panel system shall have both Factory Mutual Approval Std. 471 for Class 1 Panel Roofs and UL 580 Class 90 ratings. The manufacturer shall have a permanent, stationary, indoor production facility available for regular UL Inspections.

- E. The panels shall withstand a 250 lb. concentrated load applied to a four (4) square inch area at the center of the panel at mid-span between supports with no panel deformation, rib buckling, or panel sidelap separation which will diversely affect the weathertightness of the system.

2.03 PRODUCT APPLICATION:

- A. Roll forming of panels at the jobsite, if selected, must be performed with manufacturer owned and relocatable industrial type rolling mill having a minimum of twelve (12) stands to gradually shape the sheet metal. Installer owned or rented roll formers are not acceptable.
- B. Fasten roof (and fascia) panels to the framing members or deck with concealed anchor clips designed to allow for thermal movement of the panels except where specific fixed points are required.
- C. There shall be no exposed fasteners except to fasten flashings at fixing points, eaves, hips, ridges, rakes, laps, or as indicted on the drawings.

2.04 MATERIALS:

- A. Metal Panels - SRS 3 - 1.5 [18 inch (457 mm)]. Standing Seam Roofing System by Centria or equal as approved by Architect.
 - 1. Fabricate metal panels from 20 ga. Galvanized (.0396 nom.)
 - a. G-90 (Z275) galvanized steel conforming to ASTM A653 (A 653M) Structural Quality Grade 504 and ASTM A924 (A 924M).
 - 2. Panels shall be a minimum of 18 inches (457 mm) wide with longitudinal stiffening elements located in the pan to minimize oil-canning.
 - a. The panel system shall be designed as a true standing seam shape.
- B. Battens
 - 1. Manufacture separate (SRS 3) panel battens of the same material, finish and length as the panels and with factory applied sealant.

C. Concealed Clips

1. Fasten SRS standing seam roofing to framing members with minimum 16 gage [0.59'' (1.50 mm)], G-90 (Z275) Galvanized Steel. A 653 (A 653M) Grade 50, concealed fastening one-piece clips. Clips to be placed on 16 ga bearing plates 4'' x 4'' min.
2. One-piece clips shall provide for unlimited, unimpeded panel movement confirmed by testing, certified by an independent professional engineer. The testing shall require 100,000 cycles with 2 inch (51 mm) minimum panel movement in relation to the anchored clip.

D. Panning of panel ends is required at ridge, hip and headwall conditions when the slope is less than 3:12.

E. Finish - The coating system shall have been performance tested in accordance with ASTM procedures

1. Exterior Panels - Duragard (Polyvinylidene Fluoride) shall accept a 0.8 ± 0.05 mil primer coat on both sides with a 0.8 ± 0.05 mil 70 percent Hylar 5000 or 70 percent Kynar 500 color top coat. The exterior color shall be custom color as selected by Architect.

F. Flashing - All flashing shall be of the same material, gage, finish, and color as the panels unless otherwise indicated.

G. Accessories

1. Fasteners

- a. Screws shall be No. 14 diameter self-tapping type with a 5/8 inch (16 mm) diameter combination steel and Neoprene "Permaseal" washers.
 - 1) Exposed screws shall be 300 series stainless steel, color finished to match panel.
 - 2) Concealed screws shall be 300 series stainless steel.
- b. Blind rivets shall be solid-threaded sealed-seam type and have a weathertight neoprene washer under the head. Exposed rivets color finished to match panel.

2. Closures

- a. Precut profile closure shall be cut from cross-linked, closed-cell foam.
- b. All ridge and hip foam closures shall be protected and supported by a formed metal closure manufactured from the same material, color and finish as the roofing.
- c. Ridge closures shall be factory fabricated and hip closures shall be field cut.

3. Sealants

- a. Must not contain oil, asbestos or asphalt.
- b. Factory-applied sidelap sealant: Non-skinning, non-hardening, non-oxidizing butyl sealant, designed for metal-to-metal concealed joints.
- c. Field-applied panel end sealant: Extruded polymeric butyl tape, non-skinning and not easily displaced under compression.
- d. Exposed sealant: One component, skinning, polyurethane joint sealant. Color to be coordinated with that of panel.

4. Thermal Barriers shall be:

- a. Non-treated wood per manufacturer's recommendations.

5. Round Penetrations - Premolded EPDM boot with metal collar. Dek-Tite by Buildex or equal.

6. Vapor Retarder - Shall have a permeance of 0.05 or less as determined per ASTM E 96. Vapor retarder to be 6 mil minimum reinforced vinyl and placed on sheathing.

7. Insulation - Provide rigid board polyisocyanurate insulation in two 1 1/2" layers. Laps to be staggered per manufacturer's instructions. Total R value to be R=30.

8. Sheathing - Provide sheathing over roof decking. Sheathing to be Deusz deck or equal as approved by Architect.

10. Ice and water shield - Provide 30 mil peel and stick ice and water shield equal to Grace. Place in locations as shown on plans.
11. Commercial gutter system will be supported and braced by SRS 3 Rib Extensions System. Gutters and downspouts to be from same material, gage and finish as roof panels and to be furnished and installed as shown on plans.

H. Fascias, Soffits and Siding

1. Fascia panels and soffit panels to be same panel as roof with ribs aligned to match roof ribs.
 - a. Use same clips, fasteners and underlayment as roof.
 - b. Provide trim for fascias from same material as roof and install per details on plans.
 - c. Provide 2'' continuous soffit vent with insect screen in locations called for on the drawings.
 - d. Horizontal siding at gable end walls to match roof color.

PART 3 - EXECUTION

3.01 DELIVERY AND STORAGE:

- A. Materials shall be delivered to the site in a dry and undamaged condition and unloaded per the manufacturer's instructions. The installer shall inspect materials for damage and stains upon arrival to the site. Materials shall be stored out of contact with the ground in weathertight coverings to keep them dry per the manufacturer's recommendations. Storage accommodations shall provide good air circulation and protection from surface staining.

3.02 INSPECTION:

- A. The installer shall examine the building to verify that the structure is ready for roofing installation.
- B. All structural supports shall be in place and all sag rods, diagonal bracing and connections shall be tightened before work proceeds.
- C. Field-check dimensions and check support alignment with a taut string or wire; support misalignment will cause panel

- "oil-canning" and potentially restrict panel movement.
D. Do not proceed until unsatisfactory conditions are corrected.

3.03 INSTALLATION:

- A. Install roofing system in accordance with the approved erection drawings and instructions.
- B. All attachments shall allow for thermal expansion and contraction of the roofing panels.
- C. Install panels in one continuous length from ridge to eave.
- D. Hand-crimp battens at each clip or mechanically seam before workers can stand on the panels.
- E. Seal the top and bottom of metal closures with butyl tape [7/8 inch x 1/8 inch (22mm x 3mm)] and sealant.
- F. Seam panels and battens together with electric powered seaming machine supplied by the manufacturer to ensure sidelap weathertightness.
- G. Protect installed panels from abuse by other trades. The Construction Manager shall be responsible for protecting the roofing from wet cement, plaster and painting operations. The installer shall provide walk boards in heavy traffic areas to prevent damage to the panels.
- H. Vapor Retarder - When used over sheathing, shall be installed per the manufacturer's instructions. Any breaks or tears shall be repaired before panels are installed.
- I. Ice and water shield to be installed at perimeter conditions as required by code or as shown on plans.

3.04 DAMAGED MATERIAL AND CLEANING:

- A. Replace panels and other components of work which have been damaged beyond repair by means of finish touch-up or similar minor repair.
- B. To prevent rust staining, remove immediately from finished surfaces any filings caused by drilling or cutting.
- C. Wipe down each area after erection is complete for final acceptance.

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END OF SECTION 07610

SECTION 07620 - SNOW GUARDS

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. Work includes:
 - 1. #30 Snowguard that attaches directly to the roof deck.
 - 2. Coordinate with the installation of the roof to assure proper placement of the snowguards.
 - 3. Provide appropriate snowguard and fasteners for the roof system.
- B. Related Sections
 - 1. Section 07600: Flashing and Sheet Metal
 - 2. Section 07610: Metal Roofing
 - 3. Division 7: Thermal and Moisture Protection

1.03 SYSTEM DESCRIPTION

- A. Components:
 - 1. #30 Snowguard system consists of individual metal snowguards made from same material as roof panel.
 - 2. Fasteners
 - a. All other metals can be fastened using acceptable through fasteners as recommended by Snowguard manufacturer and approved by Metal Roof manufacturer.
 - b. All snowguards should be fastened using good soldering, fastening techniques.
- B. Design Requirements:
 - 1. Horizontal spacing not to exceed 24''
 - 2. Vertical spacing not to exceed 10'.

3. Minimum 6'' sq. of the snowguard strap soldered to the roof panel.
4. Minimum of 2 fasteners per through fastened snowguard.

1.04 SUBMITTAL

- A. Submit manufacturer's specifications, standard detail drawings and installation instructions.

1.05 QUALITY ASSURANCE

- A. Installer to be experienced in the installation of specified roofing material and snowguards for not less than 5 years in the area of the project.

1.06 DELIVER/STORAGE/HANDLING

- A. Inspect material upon delivery and order replacements for any missing or defective items. Keep material dry, covered and off the ground until installed.

PART 2 - PRODUCTS

2.01 MANUFACTURER:

- A. Snowguards by Vermont Slate & Copper Services Inc.,
P.O. Box 430, Stowe, VT (888)766-4273.

2.02 MATERIALS:

- A. Steel and painted galvanized, hood and gusset are 24 ga.

2.03 FINISH:

- A. Mill finish.
- B. Pretinned back of the strap for solder on snowguards.
- C. Kynar™ 500 or Hylar™ 5000 prepainted galvanized steel.
- D. Color to match roof color.

PART 3 - EXECUTION:

3.01 EXAMINATION:

- A. Substrate: Inspect roof system to be properly attached and installed to withstand additional loading incurred. Notify General Contractor of any deficiencies before installing Alpine SnowGuards.

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3.02 INSTALLATION:

- A. Comply with architectural drawings for location and with Manufacturer's Instructions for layout, assembly, and installation.

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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 with matching downspouts as indicated on drawings.

- B. Related Work Specified Elsewhere

- 1. 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 colors to match existing gutters and downspouts.

1.04 QUALITY ASSURANCE

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- 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

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- 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.
- B. Acceptable manufacturer: Metal Era Seal-Tite Industrial Gutter, style IG-B.

2.02 TYPE

- A. Provide Perimeter Systems' Industrial Series Commercial Gutter System (+/- 4" x 4" gutter).

2.03 MATERIALS & FABRICATION

- A. Gutter shall be manufactured from 24 gauge aluminum with Kynar finish (colors to be selected). 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 in color to match gutters.
- C. Interior Straps shall be manufactured from 0.100"x 1.00" aluminum (mill finish).

2.04 ACCESSORIES

- A. Mitered Corners, provide factory-mitered corners.

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- 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 downspout in sizes and locations to match existing (+/- 4" x 5") as indicated on plans. Downspouts shall be manufactured from 24 gauge aluminum Kynar finished to match gutter. Downspout elbows shall have heliarc welded joints. Provide 4'-0" extension at base of all downspouts.
- 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 3 brackets). Brackets shall be manufactured from 0.125"x1.00" aluminum bar, finished to match downspout color.
- D. Provide new precast concrete splash block at base of all new downspouts.

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: Selected from manuf. standard colors to match existing gutters and downspouts.

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.

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E. Install interior straps by fully engaging them into liner
and fascia, complete by securely riveting.

END OF SECTION 07711

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.
- C. Related Work Specified Elsewhere:
 - 1. Gaskets for Glazing: Section 08800 and 08810.

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" 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 AASHTO M 213.
 - 2. Provide one of the following products:
 - a. Flexcell-Celotex Corporation
 - b. Sonoflex Cane Fiber; Contec/Sonneborn
 - c. Cane Fiber 1390; A.C. Horn Corporation
 - d. Tex-Lite; J & P Petroleum Products, Inc.
 - e. Fiber; Q.R. Meadows, Inc.
 - f. Flex-JT and Gray-Flex; Old North Mfg. Co., Inc.

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. Vinylfoam: Contech/Sonneborn
 - b. Rodofom: A.C. Horn Company
 - c. FF2 PVC: Progress Unlimited, Inc.
 - d. Vinyl "U": 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. Construction Gaskets, Inc.
 - c. Hohmann & Barnard, Inc.
 - d. Kirkhill Rubber Company
 - e. F.H. Maloney Company
 - f. Progress Unlimited, Inc.
 - g. Standard Products Company
 - h. 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 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 Contractor's direction, installer, sealant manufacturer's technical representative, and other trades involved in coordination with sealant work shall meet with 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 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 contractor determines to be crucial to project), prepare written statement for Owner's record (with copy to Architect) 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 Architect 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
 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. Dymonic; Tremco Mfg. Co.
 3. Dynatrol II; Pecora Corp.
 4. Vulkem 922; Mameco
- 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

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
- 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 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. Exterior insulation and finish system.
 - a. Joints, including actual and false joints in system, at openings and penetrations in system, and joints where wall system abuts other materials.
 5. Lintels and shelf angles to masonry construction.
 6. Louvers to adjacent construction.
 7. Vertical interior expansion joints and horizontal interior and exterior control joints and expansion joints in the building.
 8. Joints in concrete site improvements (sidewalks, ramps, plaza construction, retaining walls) and the joint between the concrete slabs and dissimilar materials.
 9. Sealant in pipe sleeves where materials must perforate the floor slab.
 10. Perimeter of floor slabs or concrete curbs which abut vertical surfaces.
 11. 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.
 12. Exterior locations which are noted "caulked" or "sealant" and not specifically listed herein or included in the work of other sections of the Specifications.
 13. 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 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 08112 - HOLLOW METAL 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 hollow metal work is shown on the drawings and schedules.
- B. This section includes hollow metal doors and pressed steel frames for doors and related openings.
- C. Related Work Specified Elsewhere:
 - 1. Glass and Glazing: Section 08800 and 08810.

1.03 QUALITY ASSURANCE:

- A. Provide doors and frames complying with Steel Door Institute "Recommended Specifications: Standard Steel Doors and Frames" (SDI-100) and as herein specified.
- B. Fire-rated door assemblies shall be Underwriter Laboratory.: Where fire-rated door assemblies are indicated or required, provide fire-rated door and frame assemblies that comply with NFPA 80 "Standard for Fire Doors and Windows", and have been tested, listed, and labeled in accordance with ASTM E 152 "Standard Methods of Fire Tests for Door Assemblies". All metal labels to be riveted to door and frames mylar labels not acceptable.

1.04 SUBMITTALS:

- A. Product Data: Submit manufacturer's specifications for fabrication and installation, including data substantiating that products comply with requirements.
- B. Shop Drawings: Submit shop drawings for the fabrication and installation of hollow metal work. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections.

1. Provide a schedule of doors and frames using same reference numbers for details and openings as those on the contract drawings.

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Deliver hollow metal work cartoned or crated to provide protection during transit and job storage.
- B. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided the finish items are equal in all respects to new work and acceptable to the Architect; otherwise remove and replace damaged items as directed.
- C. Store doors and frames at the building site under cover. Place units on at least 4" high wood sills or on floors in a manner that will prevent rust and damage. Avoid the use of non-vented plastic or canvas shelters which could create a humidity chamber. If the cardboard wrappers on doors become wet, remove carton immediately. Provide 1/4" spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Hot-Rolled Steel Sheets and Strips: Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569 and ASTM 568.
- B. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.
- C. Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526, with ASTM A 525, G90 zinc coating, mill phosphatized.
- D. Supports and Anchors: Fabricate of not less than 16 gage sheet metal. Galvanize after fabrication units to be built into exterior walls, complying with ASTM A 153, Class B.
- E. Inserts, Bolts and Fasteners: Manufacturer's standard units, except hot-dip galvanize items to be built into exterior walls, complying with ASTM A 153, Class C or D as applicable.

- F. Shop-Applied Paint: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as base for specified finish paints on steel surfaces.

2.02 FABRICATION, GENERAL:

- A. Fabricate hollow metal units to be rigid, neat in appearance, and free from defects, warp or buckle. Accurately form metal to required sizes and profiles. Wherever practicable, fit and assemble units in the manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment to assure proper assembly at the project site. Weld exposed joints continuously; grind, dress, and make smooth, flush, and invisible. Metallic filler to conceal manufacturing defects is not acceptable.
- B. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat Phillips or Jackson heads for exposed screws and bolts.
- C. Finish Hardware Preparation:
1. Prepare hollow metal units to receive mortised and concealed finish hardware, including cutouts, reinforcing, drilling, and tapping in accordance with final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A 115 series specifications for door and frame preparation for hardware.
 2. Reinforce hollow metal units to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at project site.
 3. Locate finish hardware as shown on final shop drawings, or if not shown, in accordance with "Recommended Locations for Builder's Hardware", published by Door and Hardware Institute.
- D. Shop Painting:
1. Clean, treat and paint exposed surfaces of fabricated hollow metal units, including galvanized surfaces.
 2. Clean steel surfaces of mill scale, rust, oil, grease, dirt and other foreign materials before application of paint.

3. Apply pretreatment to cleaned metal surfaces, using cold phosphate solution (SSPC-PT-2), hot phosphate solution (SSPC-PT4) or basic zinc chromate-vinyl butyral solution (SSPC-PT3).
4. Apply shop coat or prime paint within time limits recommended by pretreatment manufacturer. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 2.0 mils.

E. Manufacturer: Provide hollow metal work by one of the following:

1. Ceco Door Products
2. Curries
3. Steelcraft/Div American Standard Co.

2.03 DOORS:

A. General:

1. Provide flush design doors, 1-3/4" thick, seamless hollow construction, unless otherwise indicated. Bevel both vertical edges 1/8" in 2".
2. Insulated doors: Interior core of doors to be foamed in place, closed cell, polyurethane foam chemically bonded to door face sheets. Voids in foam will not exceed 1/2" in any direction. Compressive strength of polyurethane to be minimum of 20 PSI. Foam density not less than 1-8 PCF. Polystyrene core doors not acceptable. Doors to have R factor of not less than 14.81 U factor of .068.

B. Exterior Doors:

1. Fabricate exterior doors of 2 outer, galvanized, stretcher-level steel sheets not less than 16 gage. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges except around glazed or louvered panel inserts. Provide weephole openings in the bottom of doors to permit escape of entrapped moisture.
2. Reinforce inside of doors with vertical galvanized sheet steel sections not less than 22 gage. Space vertical reinforcing 6" o.c. and extend full door height. Spot-weld at not more than 5" o.c. to both face sheets.

- a. Continuous truss-form inner core of 28 gage galvanized sheet steel reinforcing may be provided as inner reinforcement in lieu of above. Spot-weld truss-form reinforcement 3" o.c. vertically and horizontally over entire surface of both sides.
 3. Reinforce tops and bottoms of doors with 16 gage horizontal steel channels welded continuously to outer sheets. Close top and bottom edges to provide weather seal as integral part of door construction or by addition or inverted steel channels.
- C. Interior Doors:
1. Fabricate interior doors of two outer, cold-rolled, stretcher-leveled steel sheets not less than 16 gage. Construct doors with smooth, flush surfaces, without visible joints or seams on exposed faces or stile edges except around glazed or louvered panel inserts.
 2. Reinforce inside of doors with vertical, hot-rolled, not less than 22 gage steel sections. Space vertical reinforcing 6" o.c. and extend full door height. Spot weld at not more than 5" o.c. to both face sheets.
 - a. Continuous truss-form inner core of 28 gage sheet metal reinforcing may be provided as inner reinforcement in lieu of above. Spot-weld truss-form reinforcement 3" o.c. vertically and horizontally over entire surface of both sides.
 3. Reinforce tops and bottoms of doors with 16 gage, horizontal steel channels, welded continuously to outer sheets.
- D. Finish Hardware Reinforcement: Reinforce doors for required finish hardware as follows:
1. Hinges: Steel plate 3/16" thick x 1-1/2" wide x 6" longer than hinge, secured by not less than 6 spot-welds.
 2. Mortise Locksets and Dead Bolts: 14 gage steel sheet, secured with not less than two spot-welds.
 3. Cylinder Locks: 12 gage steel sheet, secured with not less than two spot-welds.

4. Flush Bolts: 12 gage steel sheet, secured with not less than two spot-welds.
5. Surface-Applied Closers: 12 gage steel sheet, secured with not less than six spot-welds.
6. Plush Plates and Bars: 16 gage steel sheet (except when through bolts are shown or specified), secured with not less than two spot-welds.
7. Surface Panic Devices: 14 gage sheet steel (except when through bolts are shown or specified), secured with not less than two spot-welds.

2.04 FRAMES:

- A. Provide hollow metal frames for doors, side-lights, borrowed lights, and other openings of sizes and profiles as indicated.
- B. Fabricate frames of full-welded unit construction with corners mitered, reinforced, continuously welded full depth and width of frame, unless otherwise indicated.
 1. Knock-down type frames are not acceptable.
- C. Form frames of galvanized steel sheets for exterior and either cold or hot-rolled sheet steel for interior.
 1. Gage: Not less than 14, for exterior openings up to and including 4'-0" wide.
 2. Gage: Not less than 14, for interior openings up to and including 4'-0" wide.
 3. For openings over 4'-0" wide, increase thickness by at least two standard gages.
- D. Finish Hardware Reinforcement: Reinforce frames for required finish hardware as follows:
 1. Hinges and Pivots: Steel plate 3/16" thick x 1-1/2" wide x 6" longer than hinge, secured by not less than six spot-welds.
 2. Strike Plate Clips: Steel plate 3/16" thick x 1-1/2" wide x 3" long.
 3. Surface-Applied Closers: 12 gage steel sheet, secured with not less than six spot-welds.

4. Concealed Closers: Removable steel access plate, 12 gage internal reinforcement of size and shape required, and enclosing housing to keep closer pocket free of mortar or other materials.
- E. Head Reinforcing: Where installed in masonry, leave vertical mullions in frames open at top for grouting.
- F. Jamb Anchors: Furnish jamb anchors as required to secure frames to adjacent construction, formed of not less than 18 gage galvanized steel.
 1. Masonry Construction: Adjustable, flat, corrugated or perforated T-shaped to suit frame size, with leg not less than 2" wide by 10" long. Furnish at least three anchors per jamb up to 7'-6" height; four anchors up to 8'-0" jamb height; one additional anchor for each 24" or fraction thereof over 8'-0" height.
 2. Metal Stud Partitions: Insert type with notched clip to engage metal stud, welded to back of frames. Provide at least four anchors for each jamb for frames up to 7'-6" in height; five anchors up to 8'-0" jamb height; one additional anchor each 24" or fraction thereof over 8'-0" height.
 3. In-Place Concrete or Masonry: Anchor frame jambs with minimum 3/8" concealed bolts into expansion shields or inserts at 6" from top and bottom and 26" o.c., unless otherwise shown. Reinforce frames at anchor locations. Apply removable stop to cover anchor bolts unless otherwise indicated.
- G. Floor Anchors: Provide floor anchors for each jamb and mullion which extends to floor, formed of not less than 14 gage galvanized steel sheet as follows:
 1. Monolithic Concrete Slabs: Clip type anchors with two holes to receive fasteners, welded to bottom of jambs and mullions.
- H. Head Anchors: Provide two anchors at head of frames exceeding 42" wide for frames mounted in steel stud walls.
- I. Head Strut Supports: Provide 3/8" x 2" vertical steel struts extending from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable bolted anchorage to frame jamb members.

- J. Structural Reinforcing Members: Provide as part of frame assembly, where indicated at mullions, transoms, or other locations which are to be built into frame.
- K. Head Reinforcing: For frames over 4'-0" wide in masonry wall openings, provide continuous steel channel or angle stiffener not less than 12 gage for full width of opening welded to back of frame at head.
- L. Spreader Bars: Provide removable spreader bar across bottom of frames, tack welded to jambs and mullions.
- M. Rubber Door Silencers: Except on weather-stripped doors, drill stops to receive three silencers on single-door frames and four silencers on double door frames. Install plastic plugs to keep holes clear during construction.
- N. Plaster Guards: Provide 26 gage steel plaster guards or dust cover boxes, welded to frame at back of finish hardware cutouts where mortar or other materials might obstruct hardware installation.

2.05 LOUVERS:

- A. Door Louvers: Fabricate louvers and mount flush into doors without overlapping moldings on surface of door facing sheets. Provide internal support as recommended by louver manufacturer. Prime paint after fabrication.
 - 1. Sightproof, stationary type, constructed of inverted Y-shaped blades formed of 20 gage cold-rolled steel.

2.06 STOPS AND MOLDINGS:

- A. Provide stops around glazed panels in hollow metal units and in frames to receive doors where indicated.
- B. Form fixed stops integral with frame, unless otherwise indicated.
- C. Provide removable stops and molds where indicated or required, formed of not less than 20 gage steel sheets matching steel on frames. Secure with countersunk machine screws spaced uniformly not more than 12 o.c.. Form corners with butted hairline joints.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Installer must examine substrate and conditions under which hollow metal work is to be installed and must notify Contractor, in writing, of any conditions detrimental to proper and timely 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. Install hollow metal units and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.
- B. Setting Masonry Anchorage Devices:
 - 1. Provide masonry anchorage devices where required for securing hollow metal frames to in-place concrete or masonry construction.
 - 2. Set anchorage devices opposite each anchor location, in accordance with details on final shop drawings and anchorage device manufacturer's instructions. Leave drilled holes rough, not reamed, and free from dust and debris.
 - 3. Floor anchors may be set with powder-actuated fasteners instead of masonry anchorage devices and machine screws, if so indicated on final shop drawings.
- C. Placing Frames:
 - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After all construction is complete, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
 - 2. Protective Coating: In masonry walls, protect inside (concealed) faces of door frames using fibered asphalt emulsion coating. Apply approximately 1/8" thick over shop primer and allow to dry before handling.
 - 3. In masonry construction, building-in of anchors and grouting of frames is included in Section 04200 of these specifications.

4. At in-place concrete or masonry construction, set frames and secure in place with machine screws and masonry anchorage devices.
5. Place frames at fire-rated openings in accordance with NFPA Standard No. 80.
6. Make field splices in frames as detailed on final shop drawings, welded and finished to match factory work.
7. Remove spreader bars only after frames or bucks have been properly set and secured.

D. Door Installation:

1. Fit hollow metal doors accurately in their respective frames with the following clearances:
 - a. Jambs and Head: 3/32".
 - b. Meeting Edges, Pairs of Doors: 1/8".
 - c. Bottom: 3/8" at threshold or carpet.
 - d. Bottom: 1/8" at threshold or carpet.
2. Place fire-rated doors with clearances as specified in NFPA Standard No. 80.
3. Finish Hardware installation is specified in Section 08710.

3.03 ADJUST AND CLEAN:

- A. Final Adjustments: Check and re-adjust operating finish hardware items in hollow metal work just prior to final inspection. Leave work in complete and proper operating conditions. Remove and replace defective work, including doors or frames which are warped, bowed or otherwise unacceptable.
- B. Prime Coat Touch-Up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

END OF SECTION 08112

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

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. 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. Interior Ceiling Application: Model L-DWR minimum size 24'' x 36'' 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.
2. 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 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 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.
- 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 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: 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: Door to have prime coat baked on enamel, white outside and grey inside.
- 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 08334 - SECURITY GRILLES

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 roll down grilles is shown on the drawings.
- B. Provide complete operating shutter assemblies including curtains, guides, counterbalance mechanisms, hardware, operators and installation accessories, as shown on the drawings and herein specified.

1.03 QUALITY ASSURANCE

- A. Provide roll down grille as a complete unit produced by one manufacturer including hardware, accessories, mounting and installation components.
- B. Manufacturer: Provide rolling shutters as manufactured by one of the following:
 - 1. Atlas Door Corp.
 - 2. Mahon Rolling Door
 - 3. Cornell Iron Works Inc.
 - 4. Kinnear Div., Harsco Corp.
 - 5. Moeschl-Edwards Co.
 - 6. J.C. Wilson Corp.
 - 7. Jim Walter Doors, Div. of Celotex Corp.
- C. Inserts and Anchorages:
 - 1. Furnish inserts and anchoring devices which must be built in for the installation of rolling shutter units. Provide setting drawings, templates, instructions, and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.

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 shutter. Include operating instructions and maintenance 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 Rolling Security Grille

- A. Furnish and install size noted on Drawings, rolling aluminum security grille, Alumatek, North American, Mahon, Kinnear, Cornell or equal approved in advance by the Architect-Engineer.
- B. Grille curtains to have solid closure for exterior use.
- C. Guides shall be extruded aluminum with return lip to prevent grille from pulling out of guides and shall be complete with wear strip to eliminate metal-to-metal contact.
- D. Brackets shall be fabricated of steel plate.
- E. Hood shall be manufacturer's standard hood for exposed installation.
- F. Barrel shall be 4'' diameter steel tubing minimum to limit deflection to .03'' per foot. Grille curtain shall be counterbalanced by oil tempered torsion springs.
- G. Operation shall be manual operation.
- H. Finish all aluminum with clear anodized finish.
- I. Provide slide lock at both sides of jamb at bottom of grille to accept padlocks supplied by owner.
- J. See plans for dimensions of existing openings. Verify all opening dimensions in field prior to fabrication.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Installer must examine the substrates and conditions under which the rolling shutter 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 shutter and operating equipment complete with necessary hardware, in accordance with final shop drawings, manufacturer's instructions, and as specified herein.
- B. Upon completion of installation including work by other trades, test and adjust shutters to operate easily, free from warp, twist or distortion.

END OF SECTION 08334

SECTION 08350 - ROLLING COUNTER SHUTTERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Manual, overhead rolling shutter.

1. Use at openings indicated on Drawings at Ticket Booth.

1.2 SUBMITTALS

A. Reference Section 01330-Submittal Procedures; submit the following items:

1. Product Data.

2. Shop Drawings: Include special conditions not detailed in Product Data. Show interface with adjacent work.

3. Quality Assurance/Control Submittals:

a. Provide proof of manufacturer ISO 9001:2000 registration.

b. Provide proof of manufacturer and installer qualifications - see 1.4 below.

c. Provide manufacturer's installation instructions.

4. Closeout Submittals:

a. Operation and Maintenance Manual.

b. Certificate stating that installed materials comply with this specification.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer Qualifications: ISO 9001:2000 registered and a minimum of five years experience in producing units of the type specified.

2. Installer Qualifications: Manufacturer's approval.

1.4 DELIVERY STORAGE AND HANDLING

A. Follow manufacturer's instructions.

1.5 WARRANTY

A. Standard Warranty: Two years from date of shipment against defects in material and workmanship.

- B. Maintenance: Submit for owner's consideration and acceptance of a maintenance service agreement for installed products.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Provide rolling shutters as manufactured by one of the following:

1. Cornell (basis of design)
2. The Cookson Co.
3. Overhead Door Company
4. The McKeon Rolling Door Company
5. Wayne Dalton
6. Crawford Door
7. Amarr
8. Clopay

- B. Model: ESC10 (Refer to drawings for sizes and locations)

2.2 MATERIALS

- A. Curtain:

1. Slats: No. 5F, 22 gauge AISI type 304 stainless steel.
2. Bottom Bar: Two 2x2x1/8 inch (50x50x3.2 mm) AISI 300 series stainless steel angles.
3. Fabricate interlocking continuous slat sections with high strength steel endlocks secured with two 1/4" (6.35 mm) rivets per UL requirements.
4. Slat Finish:
 - a. Stainless steel: No. 4 finish.
5. Bottom Bar Finish:
 - a. Stainless steel: No. 4 finish.

- B. Guides: Fabricate with minimum 3/16 inch (4.76 mm) stainless steel angles. Top of inner and outer guide angles to be flared outwards to form bellmouth for smooth entry of curtain into guides. Provide removable guide stoppers to prevent over travel of curtain and bottom bar.

1. Finish:
 - a. Stainless steel: [No. 4 finish] [Mill finish].

C. Counterbalance Shaft Assembly:

1. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot (2.5 mm per meter) of width.
2. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will not exceed 25 lbs (110 N). Provide wheel for applying and adjusting spring torque.

D. Brackets: Fabricate from minimum 1/4 inch (6.35 mm) steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures.

1. Finish:

- a. Phosphate treatment followed by baked-on polyester powder coat, custom color as selected by Architect; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.

E. Hood: 24 gauge stainless steel with reinforced top and bottom edges. Provide minimum 1/4 inch (6.35 mm) steel intermediate support brackets as required to prevent excessive sag.

1. Finish:

- a. Stainless steel: No. 4 finish.

2.3 ACCESSORIES

A. Locking:

1. Padlockable slide bolt on coil side bottom bar at each jamb extending into slots in guides.

B. Operator and Full Bracket Mechanism Cover: Provide 24 gauge stainless steel sheet metal cover to enclose exposed moving operating components at coil area of unit. Finish to match door hood.

2.4 OPERATION

A. Manual Push-Up with Conventional Spring Release System: Provide lift handles on bottom bar and pole with hook.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings.
- B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.
- C. Commencement of work by installer is acceptance of substrate.

3.2 INSTALLATION

- A. General: Install door and operating equipment with necessary hardware, anchors, inserts, hangers and supports.

3.3 ADJUSTING

- A. Following completion of installation, including related work by others, lubricate, test, and adjust doors for ease of operation, free from warp, twist, or distortion.

3.4 FIELD QUALITY CONTROL

- A. Site Test: Test doors for normal operation and automatic closing. Coordinate with authorities having jurisdiction to witness test and sign Drop Test Form.

3.5 CLEANING

- A. Clean surfaces soiled by work as recommended by manufacturer.
- B. Remove surplus materials and debris from the site.

3.6 DEMONSTRATION

- A. Demonstrate proper operation, testing and reset procedures to Owner's Representative.
- B. Instruct Owner's Representative in maintenance procedures.

END OF SECTION 08350

SECTION 08520 - ALUMINUM WINDOWS - **SLIDING WINDOW**

PART 1 - GENERAL

1.01 Summary

- A. Section Includes: Kawneer Sealair® Commercial Grade and Heavy Commercial Architectural Aluminum Windows, including glass and glazing at window manufacturer's factory, perimeter trims, sills and stools, window installation hardware and accessories, shims and anchors, and perimeter sealing of window units.
1. Types of Kawneer Sealair Aluminum Windows include:
 - a. Series 8400TL, Model 8470; Thermal, 4" Deep Master Frame, Horizontal Sliding (HC55).
 2. Others as approved by Architect.

1.02 System Description

- A. Reference Standard Compliance: Comply with ANSI/AAMA 101 for minimum performance criteria for aluminum windows, including grade designation windows units.
1. Test Units: Conform to minimum size in accordance with ANSI/AAMA 101 for each test unit sizes and configurations. Units submitted for laboratory testing shall be manufacturer's standard construction, glazed and assembled in accordance with manufacturer's specifications and ANSI/AAMA 101.
- B. Window Performance Requirements:
1. Air Infiltration: When closed and locked, the test specimen shall be tested in accordance with ASTM E283 at a minimum frame size of 96" x 80" (HC). Air infiltration rate shall not exceed 0.30 cfm/ft of sash perimeter at a static air pressure differential of 1.57 psf.
 2. Water Resistance: When closed and locked, the test specimen shall be tested in accordance with ASTM E547 and ASTM E331 at a minimum frame size of 96" x 80" (HC). There shall be no leakage as defined in test method at a static air pressure differential of 10 psf.

3. Uniform Load Deflection: When closed and locked, a minimum static air pressure difference of 55 psf shall be applied in the positive and negative direction in accordance with ASTM E330. There shall be no deflection in excess of $L/175$ of the span of any framing member.
4. Uniform Load Structural Test: When closed and locked, a minimum static air pressure difference of 82.5 psf shall be applied in the positive and negative direction in accordance with ASTM E330. The unit shall be evaluated after each load.
5. Thermal Transmittance (U-value): When tested to AAMA Specification 503.1, the thermal transmittance (U-value) shall not be more than 0.74 BTU/hr/sf/°F.
6. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than 51.
7. Forced Entry Resistance: Windows shall conform to ASTM F588, Performance Level 10, or AAMA 1302.5.

- C. System Performance Requirements: Provide aluminum windows which have been manufactured, fabricated and installed to withstand uniform loads from 65 psf and to maintain (manufacturer's performance criteria) without defects, damage, or failure.

1.03 Submittals

- A. General: Prepare, review, approve, and submit product data, shop drawings, samples, and other submittals in accordance with "Conditions of the Contract" and Division 1 Submittals Sections. Product data, shop drawings, samples, and similar submittals are defined in "Conditions of the Contract."

1.04 Warranty

- A. Project Warranty: Refer to "Conditions of the Contract" for project warranty provisions.
- B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty.
1. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin

in no event later than six months from date of shipment by Kawneer.

2. Insulating Glass: Warranted to be free from defects (excluding breakage) for a period of five (5) years.

1.05 Quality Assurance

A. Qualifications:

1. Installer Qualifications: Installer experienced (as determined by contractor) to perform work of this section who has specialized in the installation of work similar to that required for this project and who is acceptable to product manufacturer.
2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction, approving acceptable installer and approving application method.

- B. Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements

PART 2 - PRODUCTS

2.01 Manufacturer's (Acceptable Manufacturer's/Products)

- A. Acceptable Manufacturer's: Kawneer Company, Inc., EFCO, Wausau and Graham.
1. Spec is based on Kawneer Sealair Architectural Windows.
 - a. Series: SealAir 8400TL, model 8470 sliding window.
 - b. Finish color: Kynar finish. Color: To be selected from standard colors.
 2. Product/Systems Testing:
 - a. ANSI/AAMA: Comply with ANSI/AAMI 101 and AAMA 910 floor minimum product performance criteria.
 3. Manufacturer is to provide single source for all windows, curtain wall and storefront on project. Mixing and matching of more than one manufacturer is not allowed.

2.02 Materials

- A. Aluminum (Windows and Components):
1. Material Standard: ASTM B221, G.S. 10A-T5; 6063-T5 alloy and temper.
 2. Frame Depth: Not less than 4" (101.6 mm).
 3. Member Wall Thickness: Each master frame member shall have minimum wall thickness of 0.070" (1.78 mm) and shall provide structural strength to meet specified performance requirements. Each sash member shall have a minimum wall thickness of 0.080" (2.03 mm). All vertical sash members shall be tubular construction. Meeting rail shall have a continuous interlock with double weather stripping.
 4. Dimensions: Reference to dimensions for wall thickness and other cross-sectional dimensions of window members are nominal and in compliance with ANSI H35.2-1990.
- B. Mullions and Cover Plates: Shall be extruded aluminum of 6063-T5 alloy and temper of profile and dimensions indicated on drawings. Mullions shall provide structural properties to resist wind pressure required by performance criteria and standards.
- C. Thermal Barrier.
1. Frame thermal barrier shall be Kawneer Isolock® with a minimum of 5/16" (7.9) separation consisting of a two-part, chemically curing high density polyurethane which is mechanically and adhesively bonded to the aluminum.
 2. Sash thermal barrier shall be Kawneer Isolock® with a minimum of 1/4" (6.4) separation consisting of a two-part, chemically curing high density polyurethane in conditioned thermal pockets which is mechanically and adhesively bonded to the aluminum.

2.03 Accessories

- A. Fasteners: Where exposed, shall be 300 Series, Stainless Steel.
- B. Perimeter Anchors: Aluminum. When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

- C. Hardware: Manufacturer's standard corrosion resistant hardware material compatible with aluminum.
 - 1. Manufacturer's cast white bronze push button style lock.
- D. Insect Screens: Extruded aluminum frames, 6063-T5 alloy and temper, joined at corners; 18 x 16 mesh aluminum screen cloth; frames finished to match aluminum windows; splines shall be extruded vinyl, removable to permit rescreening.
- E. Muntin Grids: Extruded aluminum profiles, 6063-T5 alloy and temper and as follows:
 - 1. True Muntins.

2.04 Glass and Glazing

- A. General: Glass thickness and type shall be in accordance with manufacturer's recommendations for prescribed design pressure. Factory glazing shall be in accordance with manufacturer's standard requirements.
 - 1. Material Compatibility: Glazing materials shall be compatible with aluminum and FRP panels (where indicated).
 - 2. Manufacturer's Standards: Glazing method shall be a wet/dry type in accordance with manufacturer's standards. Exterior glazing shall be pre-shimmed glazing tape. Interior glazing shall be snap-in type 0.062" (1.57 mm) glazing beads and a compression gasket of dense elastomer in accordance with ASTM C864.
- B. Glass Materials: (Specifier To Choose)
 - 1. Insulating Glass: ASTM E774, NAMI Dual-Seal or Single-Seal as selected.
 - 2. Safety Glazing: ANSI Z97.1 or CPSC 16 CRF 1201.
 - 3. Tempered Glass: ASTM C1048.
 - 4. Glass Type: Temp. glass-exterior pane, laminated glass-interior pane.

5. Glass Thickness 1'' consisting of ¼'' exterior
1/2" spacer 1/4" interior.

PART 3 - EXECUTION

3.01 Manufacturer's Instructions/Recommendations

- A. Compliance: Comply with manufacturer's product installation data and recommendations for installation requirements of window units, hardware, and other components in accordance with manufacturer's warranty provisions.

3.02 Examination

- A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions. Verify openings are sized to receive window units and sill plate is level in accordance with manufacturer's acceptable tolerances.
 1. Field Measurements: Verify field measurements for window installation.

3.03 Preparation

- A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.

3.04 Installation

- A. General: Install window units plumb, level, and true to line, without warp or rack of frames or sash with manufacturer's prescribed tolerances. Provide support and anchor in place.
 1. Dissimilar Materials: Provide separation of aluminum materials and other corrodible surfaces from sources of corrosion or electrolytic action contact points by complying with AAMA 101, Appendix, titled "Dissimilar Materials."
 2. Weathertight Construction: Install sill members and other members in a bed of sealant or with joint filler or gaskets, to provide weathertight construction. Coordinate installation with wall flashings and other components of construction.

- a. Refer to Division 7 Joint Treatments (Sealants) for installation requirements.

B. Related Products Installation Requirements:

1. Insulation (Window): Refer to Division 7 Building Insulation Section.
2. Sealants (Perimeter): Refer to Division 7 Joint Treatment (Sealants) Section.
3. Glass: Refer to Division 8 Glass and Glazing Section.

3.05 Field Quality Control

- A. Field Tests: Architect shall select window units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer's representative present. Tests not meeting specified performance requirements and units having deficiencies shall be corrected as part of the contract amount.
 1. Testing: Testing shall be performed by a qualified independent testing agency. Refer to Division 1 Testing Section for payment of testing and testing requirements. Testing Standard per AAMA 502, including reference to ASTM E 783 for Air Infiltration Test and ASTM E 1105 Water Infiltration Test.
 - a. Air Infiltration Tests: Conduct tests in accordance with ASTM E 783. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.15 cfm per foot of crack length, which ever is greater.
 - b. Water Penetration Tests: Conduct tests in accordance with ASTM E 1105. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 6.24 psf.
- B. Manufacturer's Field Services: Provide manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's instructions.

3.06 Adjusting and Cleaning

- A. Adjusting: Adjust operating window components to provide a tight fit at contact points and at weatherstripping for smooth operation and a weathertight closure.
- B. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.
- C. Protection: Protect installed product's finish surfaces from damage during construction. Protect aluminum windows from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants. Remove and replace damaged aluminum windows at no extra cost.

END OF SECTION 08520

SPEC 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 1 - General Requirements
2. Division 6 - Rough Carpentry
3. Division 6 - Finish Carpentry: Installation of Finish Hardware
4. Division 8 - Steel Doors and Frames
5. Division 8 - Aluminum Framed Entrances and Storefronts

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. 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. 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

- b. Hardware Locations: Refer to Article 3.1 B.2 Locations.
- c. Opening Description: Single or pair, number, room locations, hand, active leaf, degree of swing, size, door material, frame material, and UL listing.
- d. Hardware Description: Quantity, category, product number, fasteners, and finish.
- e. Headings that refer to the specified Hardware Set Numbers.
- f. Scheduling Sequence shown in Hardware Sets.
- g. Product data of each hardware item, and shop drawings where required, for special conditions and specialty hardware.
- h. Electrified Hardware system operation description.
- i. "Vertical" scheduling format only. "Horizontal" schedules will be returned "Not Approved."
- j. Typed Copy.
- k. Double-Spacing.
- l. 8-1/2 x 11 inch sheets
- m. 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. 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 Warranties

- A. Mortise locksets shall carry manufacturer's 3-year warranty against manufacturing defects and workmanship.
- B. Closers shall carry manufacturer's 10-year warranty against manufacturing defects and workmanship.
- C. Exit devices shall carry manufacturer's 3-year warranty against manufacturing defects and workmanship.
- D. Continuous gear hinges shall carry manufacturer's Lifetime warranty to be free from defects in material and workmanship.
- E. ADA Special Closers shall carry manufacturer's 2-year warranty against manufacturing defects and workmanship.
- F. Balance of items shall carry a manufacturer's 1-year warranty against manufacturing defects and workmanship.
- G. During the warranty period, replace defective work, including labor, materials and other costs incidental to the work. Inspect the work within 24 hours after receipt of notice from the Owner. Replace work found to be defective as defined in the General Conditions.

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:

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1. Unless specified otherwise in sets furnish hinges of class and size as follows:
2. Furnish class 5BB1 and size 4-1/2 x 4-1/2 inches.
3. Numbers used are Ives. Equal products of Bommer and Hager 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 Select Products, Ltd., Kalamazoo, Michigan.
 - a. For Wood and Hollow Metal frames;
 - 1) Select Products Ltd. SL24HD
 - b. For Aluminum and FRP frames;
 - 1) Select Products Ltd. SL11HD

C. Flush Bolts:

1. Constant Latching: metal doors:
 - a. IR-Ives FB50 Series
 - b. Equal product of any B.H.M.A. member.
2. Constant Latching: wood doors:
 - a. IR-Ives FB60 Series
 - b. Equal product of any B.H.M.A. member.
3. Manual - wood and metal doors:
 - a. IR-Ives FB458 Series
 - b. Equal product of any B.H.M.A. member.

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4. Dust Proof Strikes - furnish with all flush bolts, except at openings having thresholds:
 - a. IR-Ives DP2
 - b. Equal product of any B.H.M.A. member.

D. Locksets and Latchsets - Mortise Type:

1. Locksets shall be manufactured from heavy gauge steel, minimum lockcase thickness 1/8", containing components of steel with a zinc dichromate plating for corrosion resistance.
2. Locks are to have a standard 2 3/4" backset with a full 3/4" throw two-piece stainless steel mechanical anti-friction latchbolt. Deadbolt shall be a full 1" throw, constructed of stainless steel.
3. Lockcase shall be easily handed without chassis disassembly by removing handing screw on lockcase and installing in opposite location on reverse side. Changing of door hand bevel from standard to reverse hand shall be done by removing the lockcase scalp plate, and pulling and rotating the latchbolt 180 degrees.
4. Lock trim shall be through-bolted to the door to assure correct alignment and proper operation. Lever trim shall have external spring cage mechanism to assist in support of the lever weight. Thumb turns shall have "EZ" thumbturn equal to IR-Schlage L583-363.
5. Function numbers are IR-Schlage.
 - a. IR-Schlage L9000
6. Lockset Trim:
 - a. IR-Schlage 93N
7. 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 door frame trim at single doors and have 7/8" lip to center at pairs of 1-3/4" doors.

E. Exit Devices:

1. Exit devices shall be touchpad style, fabricated of brass, bronze, stainless steel, or aluminum, plated to the standard architectural finishes to match the balance of the door hardware.

2. All exit devices shall incorporate a fluid damper, which decelerates the touchpad on its return stroke and eliminates noise associated with exit device operation. Touchpad shall extend a minimum of one half of the door width. All latchbolts to be deadlatching type, with a self-lubricating coating to reduce wear.
3. End-cap will be sloped to deflect any impact from carts and they shall be flush with the external mechanism case. End caps that overlap and project above the mechanism case are unacceptable. End cap shall utilize a two-point attachment to the mounting bracket.
4. Touchpad shall match exit device finish, and shall be stainless steel for US26, US26D, US28, US32, and US32D finishes. Only compression springs will be used in devices, latches, and outside trims or controls.
5. Plastic templates shall be included with each exit device to facilitate a quick, easy and accurate installation.
6. Strikes shall be roller type and come complete with a locking plate to prevent movement.
7. All rim and vertical rod exit devices shall have passed a 5 million(5,000,000) cycle test based on ANSI A156.3, 1994, Grade 1 test standards and certified by an independent testing lab.
8. All mortise exit devices shall have passed a 10 million(10,000,000)cycle test based on ANSI A156.3, 1994, Grade 1 test standards and certified by an independent testing lab.
9. Exit devices shall be UL listed panic exit hardware. All exit devices for fire rated openings shall be UL labeled fire exit hardware.
10. Lever trim for exit devices shall be vandal-resistant type, which will travel to a 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.
11. IR-Von Duprin 98 and 35A Series. Series and function numbers as listed in sets.
12. Trim:
 - a. As specified in sets.
 - b. Levers to match lockset design where specified.

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F. Removable Mullion:

- a. Exterior doors
 - 1) Special-Lite SL-60KR
- b. Interior/Exterior, hollow metal or wood, mullion is removable only through the use of building keys.
 - 1) IR-Von Duprin KR4954
- c. Interior Doors - UL listed, Mullion is removable only through the use of building keys.
 - 1) IR-Von Duprin KR9954

G. Push and Pull Hardware:

1. Push Plates: Ives 8200 Series 6 x 16 x .050 inches. If stile widths will not accept 6 inches, provide stile width less two inches.
2. Push Bars: IR-Von Duprin 330
3. Pull Plates: IR-Ives 8303-8 4 x 16 x .050 inches. 8" center.
4. Pull, Bi-Fold: Dummy Lever Trims. Levers to match lockset lever design.
5. Vandal Resistant Pulls: IR-Ives VR900 Series. Stainless steel construction 0.120 inches thick.
6. Manufacturer: Provide push and pull hardware from any member of B.H.M.A.

H. Coordinator - Frame Stop Mounted:

1. Door coordinator shall prevent the active door from closing before inactive door. Stop mounted channel 1-5/8" x 5/8" steel tubing x length to suit door opening. Coordinator shall be UL listed. Furnish filler bars to fill gap between end of coordinator and inactive door frame. Furnish mounting brackets for all stop mounted hardware such as exit device strikes, door closer PA shoes, etc. Coordinators shall be prepared (cutout) at the factory for surface applied or concealed vertical rod panic devices if required.
2. Furnish with carry bar CB1 when required for proper operation.
 - a. IR-Ives COR x length to suit.
 - b. Equal products of any BHMA manufacturer

I. Electric Power Transfer:

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1. Transfer power from door frame to edge of door, UL listed R4504.
2. IR-Von Duprin EPT

J. Closers:

1. Door closers shall have fully hydraulic, full rack and pinion action with a high strength cast iron cylinder. Cylinder body shall be 1 ½" in diameter, and double heat treated pinion shall be 11/16" in diameter with double D slab drive arm connection.
2. Hydraulic fluid shall be of a type requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
3. Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force for the physically handicapped. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed, and backcheck.
4. All closers shall have solid forged steel main arms (and forged forearms for parallel arm closers).
5. All surface mounted mechanical closers shall be certified to exceed ten million (10,000,000) full load cycles by a recognized independent testing laboratory.
6. Closers will have Powder coating finish certified to exceed 100 hours salt spray testing by ETL, an independent testing laboratory used by BHMA for ANSI certification.
7. 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.
8. IR-LCN Series as listed in sets.

K. ADA Special Closers

1. Where "Low Energy Power Operated Door" as defined by ANSI Standard A156.19 is indicated for doors required to be accessible to the disabled, provide electrically powered 4640 series operators complying with the ADA

- requirements for opening force and time to close standards.
2. Full closing force shall be provided when the power or assist cycle ends.
 3. Modular design, adjustments easily accessible from the front, UL listed for use on labeled doors.
 4. Shall have "Second Chance" function to accommodate momentary resistance, "Breakaway" function in the electronically controlled clutch, "Soft Start" motor control function and "Maintain Hold-Open Switch" to hold the door open at 90 degree.
 5. Shall have built in 12V and 24V power supply for actuators, card readers, electric strikes and magnetic door locks, inputs for both swing and stop side sensors and available to accept either 120VAC or 220VAC input power. All wiring connections between operator modules made by easy-to-handle electrical connectors. Shall comply with both UL and NEC requirements for Class 1 and Class 2 wiring by providing separate conduits for each.
 6. Shall have seven independent electronic adjustments to tailor the operator for specific site conditions. Opening speed, holding force at 90 deg., sequential trigger and time delay, hold-open time at 90 deg., opening force, clutch "breakaway" force setting, electric strike trigger and time delay.
 7. Shall have separate and independent adjustments for back check, main speed and latch speed.
 8. Furnish actuators and other controls as shown in Hardware Sets.

L. 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.

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3. Type, function, and fasteners must be the same as Glynn-Johnson specified. Size per manufacturer's selector chart.
 - a. IR-Glynn-Johnson

M. Kick Plates:

1. Furnish .050 inches thick 10" high x door width less 1.5" 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.

N. Wall Stops:

1. Length to exceed projection of all other hardware. Provide with threaded studs and expansion shields for masonry wall construction.
 - a. IR-Ives WS33
 - b. BHMA L12011 or L12021

O. Wall Holders:

1. Products specified by series only; furnish strike length to exceed projection of all other hardware.
2. Wall holder must allow doors that swing up to 118 degrees to be held open.
 - a. IR-Ives FS495
 - b. Equal products of any BHMA manufacturer

P. Door Holding Devices:

1. Electrically controlled, fail-safe, holds door open until current is interrupted.
2. Furnish model to hold door away from wall to allow for any trim or levers on pull side of door.
 - a. IR-LCN SEH series

Q. Thresholds:

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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 Pemko or Reese

R. Door Sweeps:

1. Surface Sweeps:
 - a. National Guard as listed in sets
 - b. Equal by Pemko or Reese

S. Weather-stripping:

1. Apply to head and jamb stops.
2. Solid Bar stock all sides
 - a. National Guard as listed in sets
 - b. Equal by Pemko or Reese

T. Meeting Stile Weather-stripping:

1. 2 Pc. Nylon brush type to seal gap between pairs of doors.
 - a. National Guard as listed in sets
 - b. Equal by Pemko or Reese

U. Miscellaneous:

1. Furnish items not categorized in the above descriptions but specified by manufacturer's names in Hardware Sets.

V. 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. Supply sex bolts for closers at lead-lined doors.
3. 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.
- B. Color to match FRP door color on FRP doors.

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 existing Best system according to Owner's instructions.

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Provide two change keys for each cylinder, master and grand master keys as required by Owner.

- E. Provide cylinders with construction cores for use during the construction period. When so directed, and in the presence of the Owner's security department or representative, the Best representative will convert construction cores to the final system.
- F. At the request of the Architect and when performing changeover from construction key system to final key system deliver to the Architect or Owner's Representative the following:
 - 1. Control Keys.
 - 2. Change Keys

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. Reinforced hollow metal doors and frames and reinforced aluminum door and frames will be drilled and tapped for machine screws.
- 3. Solid wood doors and frames: full thread wood screws. Drill pilot holes before inserting screws.
- 4. 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.
- 5. Continuous Gear Hinges require continuous mortar guards of foam or cardboard 1/2" thick x frame height, applied with construction adhesive.
- 6. Refer to Article 2.5.E, cylinders and keying regarding conversion of construction cores to final cores.
- 7. Install weather-strip gasket prior to parallel arm closer bracket, rim exit device or any stop mounted

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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 Plates	52"
Pull Plates	42"
Wall Stops/Holders	At Head

C. Final Adjustment:

1. Provide the services of a representative to inspect material furnished and its installation and adjustment, to make final hardware adjustment, and to instruct the Owner's personnel in adjustment, care and maintenance of hardware.
2. Locksets, closers and exit devices shall be inspected by the factory representative and adjusted after installation and after the HVAC system is in operation, to insure correct installation and proper adjustment in operation. The manufacturer's representative shall prepare a written report stating compliance, and also recording locations and kinds of noncompliance. The original report shall be forwarded to the Architect with copies to the Contractor, hardware distributor, hardware installer and building owner.

D. Technical and Warranty Information:

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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:

HW SET: 01

2	EA	CONTINUOUS	SL11 HD 83"	628	SEL
		HINGE			
1	PR	MANUAL FLUSH	FB458	626	IVE
		BOLT			
1	EA	CORE		626	BES
1	EA	STOREROOM LOCK	L9080BDC LLL 93A L283-150	626	SCH
1	EA	FLUSH PULL	SL-82	628	SPE
1	EA	SURFACE CLOSER	4111 SHCUSH	689	LCN
1	SET	WEATHER SEAL	(PROVIDED BY DOOR & FRAME MFR)		
2	EA	DOOR SWEEP	600A	AL	NGP
1	EA	THRESHOLD	425 36"	AL	NGP

HW SET: 02

1	EA	CONTINUOUS	SL11 HD 83"	628	SEL
		HINGE			
1	EA	PANIC HARDWARE	99NL-OP 3'	626	VON
1	EA	CORE		626	BES
1	EA	RIM CYLINDER	80-110	626	SCH

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1	EA	FLUSH PULL	SL-84	628	SPE
1	EA	SURFACE CLOSER	4111 CUSH	689	LCN
1		SET WEATHER SEAL	(PROVIDE BY DOOR & FRAME MFR)		
1	EA	DOOR SWEEP	600A	AL	NGP
1	EA	THRESHOLD	425 36"	AL	NGP

HW SET: 03

1	EA	CONTINUOUS HINGE	SL24 HD 83"	628	SEL
1	EA	STOREROOM LOCK	L9080BDC LLL 93A L283-150	626	SCH
1	EA	CORE		626	BES
1	EA	DOOR PULL	VR900LLP	630	IVE
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	WALL STOP	WS33	626	IVE
1		SET WEATHER SEAL	(PROVIDE BY DOOR & FRAME MFR)		
1	EA	DOOR SWEEP	600A	AL	NGP
1	EA	THRESHOLD	425 36"	AL	NGP

HW SET: 04

1	EA	CONTINUOUS HINGE	SL24 HD 83"	628	SEL
1	EA	OFFICE LOCK	L9050BDC 93N L583-363	626	SCH
1	EA	CORE		626	BES
1	EA	WALL STOP	WS33	626	IVE

HW SET: 05

1	EA	CONTINUOUS HINGE	SL11 HD 83"	628	SEL
1	EA	CLASSROOM LOCK	L9070BDC 93N	626	VON
1	EA	CORE		626	BES
1	EA	RIM CYLINDER	80-110	626	SCH
1	EA	FLUSH PULL	SL-84	628	SPE
1	EA	SURFACE CLOSER	4111 CUSH	689	LCN
1		SET WEATHER SEAL	(PROVIDE BY DOOR & FRAME MFR)		
1	EA	DOOR SWEEP	600A	AL	NGP
1	EA	THRESHOLD	425 36"	AL	NGP

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END OF SECTION 08710

08740 - FLUSH FRP DOORS, STILE & RAIL ALUMINUM DOORS

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 doors.
 - 2. Aluminum frames.

1.3. RELATED WORK SPECIFIED ELSEWHERE

- A. Finish Hardware, Section 08710.
- B. Caulking, Section 07920
- C. Glazing, Section 08800

1.4. SYSTEM PERFORMANCE
FRP 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 01340 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 and support at mechanical joints, with hairline fit at contacting members.
- E. Attachment of all hardware shall be made using machine screws which are supplied by the manufacturer.
- F. All holes shall be drilled and tapped using the

recommended drill size for the tap required.

- G. Frames stops shall be applied stops, Minimum 5/8" high x Minimum 1 1/4" wide.
- H. Frame tube sections shall be closed back, minimum of 1/8" wall thickness
- 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 not practical to have solid bar stock reinforcement at attachment points, use "RIV-NUTS" for attachment of hardware items.

2.5. FIBERGLASS REINFORCED POLYESTER FRP FLUSH DOORS

A. Materials and Construction

1. Construct 1-3/4" thickness doors of 6063-T5 aluminum alloy stiles and rails minimum 2-5/16" depth. Provide joinery of 3/8" diameter full width tie rods through extruded splines top and bottom as standard .125" tubular shaped stiles and rails reinforced to accept hardware as specified. Provide hex type aircraft nuts for joinery without welds, glues or other methods for securing internal door extrusions. Furnish integral reglets to accept face sheet to permit a flush appearance. Rail caps or other face sheet capture methods are not acceptable. Color as selected by Architect.
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" thickness fiberglass reinforced polyester. SL-17 doors with pebble-like embossed pattern of the standard colors: as selected by Architect.
4. Core of Door Assembly: Minimum five pounds per cubic foot density poured-in-placed polyurethane free of CFC and HCFC. Minimum "R" value of 11. Meeting stiles on

- pairs of doors, and weather bars with nylon brush weatherstripping.
5. Manufacture doors with cutouts for vision-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 all doors with built in flush pulls SL82, to match door color.

2.8. ALUMINUM FRAMING SYSTEMS

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 weatherstripping. 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 preassemble sidelites to the greatest extent possible, and mark frame assemblies according to location.
6. Coordination of Fabrication: Field measure before fabrication, and show recorded measurements on final

shop drawings.

7. 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".
8. No welding of doors or frames is acceptable.
9. Maintain continuity of line and accurate relation of planes and angles. Secure attachments and support at mechanical joints, with hairline fit at contacting members.
10. Attachment of all hardware shall be made using machine screws which are supplied by the manufacturer.
11. All holes shall be drilled and tapped using the recommended drill size for the tap required.
12. Frames stops shall be applied stops, Minimum 5/8" high x Minimum 1 1/4" wide.
13. 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
14. Where it is not practical to have solid bar stock reinforcement at attachment points, use "RIV-NUTS" for attachment of hardware items.

2.9. 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.
- B. Security Grate Option: Security grate model SL-349 as manufactured by Special-Lite, Inc., Decatur, Michigan.

2.10. Aluminum Finishes

- A. Anodized Surfaces: AAM12C22A42 in custom color as selected by Architect.

3. EXECUTION

3.1. Installation

- A. Comply with manufacturer's recommendations 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. Provide a minimum one-year written warranty on all labor related to this section. Any workmanship which is defective or deficient shall be corrected to the Owner's satisfaction and at no additional cost to the Owner.

END OF SECTION 08740

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 exterior doors.
- C. Related Work Specified Elsewhere:
 - 1. Carpentry: Section 06100
 - 2. Interior Architectural Woodwork: Section 06402
 - 3. Hollow Metal Work: Section 08112

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. 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
 - Exterior Glass: 1/8" clearplate glass
 - Laminating Film: 30 mils thick
 - Interior Glass: 1/8" clearplate glass

2. Insulating Glass:

- a. Fabricate and label units to match units which have been tested and certified by the Insulating Glass Certification Council in accordance with proposed standard ASTM E6-P3, Test Methods, P1 and P2 (as sponsored by the Sealed Insulating Glass Manufacturers Association); and passed tests for glass seal classification "A".
- b. Fabricate units with a permanent, hermetically sealed dry air or glass filled space of the width indicated between sheets of glass as indicated. Provide an edge seal consisting of twin primary sealant beads of silicone positioned and retained by a tubular aluminum or galvanized steel spacer-bar frame with soldered/welded sealed corners, and filled with desiccant with breather ports into sealed space; with secondary edge sealant completely encapsulating outer face of spacer bar and sealed to the opposing sheets of glass. Provide silicone elastomeric sealant as secondary edge seal.
 - (1) Extend secondary sealant to provide minimum of 1/16" thick elastomeric coating on edges of glass sheets in each insulating glass unit (to form a protective edge cushion).
 - (2) Width: Except as otherwise indicated, fabricate units with 1/2" wide air spaces.
 - (3) Fill air spaces by fabricator's standard process, using either gas or dry air with a maximum dew point of -20 degrees F. Exercise extreme care to exclude dirt and other foreign substances.
- c. Label each unit to show compliance with required standards and regulations, and to list generically each component including elements of edge seal. Indicate which face of unit is for exposed to exterior of weather. Provide removable label except where regulations require a permanent label.
 - (1) Label interior-exposed edge of spacer bar with fabricator's name and date of completing hermetic seal.
- d. Provide the following types:

(1) 1" Clear:

Exterior Glass: 1/4" clear plate.

Interior Glass: 1/4" clear plate.

(2) Where required for compliance with safety glass regulations, provide tempering.

B. Design Thickness:

1. Verify all glass thicknesses will comply with performance requirements.

C. Manufacturer of Glass: One of the following:

1. AFG Industries Inc.
2. Pilkington
3. LOF Glass Inc.
4. PPG Industries, Inc.
5. Guardian Industries
5. Technical Glass Products

D. Edges:

1. Polish edges wherever exposed to view.

E. Coatings:

1. Provide low emissivity (low-E) pyrolytic coating.

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. Architect 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. Two-Component Polysulfide Glazing Sealant:
1. Polysulfide-based, 2--art elastomeric sealant, comply with FS TT-S-00227, Class A, Type 2 (non-sag); certified by manufacturer to be specifically compounded for glazing application, with sufficient resistance to UV deterioration to show no significant change for 20 years of normal glazing exposure to the sun.

2. Product/Manufacturer:
 - a. Lasto-Meric; Tremco, Inc.
 3. Use for cap bead on all sloped glazing.
- F. 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
- G. 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 window wall and in metal framed skylight and all interior glazing except wire glass.
- H. Oleo-Resinous Glazing Compound:
1. Oil-based resinous glazing compound recommended by the manufacturers specifically for glazing in the configuration indicated (either channel/stop or face glazing), non-staining, non-bleeding; and where used for face glazing, comply with FS TT-G-410.
 2. Use for wire glass.

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 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 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 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

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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

1.1RELATED DOCUMENTS:

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

1.2SUMMARY:

- 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.

1.3DEFINITIONS:

- 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.

1.4SUBMITTALS:

- A. Product data from manufacturers for each type of product specified.

1.5QUALITY 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.

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. Gold Bond Building Products Div., National Gypsum Co.
 - b. Incor, Inc.
 - c. Marino Industries Corp.

2. Gypsum Boards and Related Products:
 - a. Georgia-Pacific Corp.
 - b. Gold Bond Building Products Div., National Gypsum Co.
 - c. United States Gypsum Co.
 - d. Domtar Gypsum

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 7/8 inch, 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: 7/8 inch.
 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.

2.4GYPSUM 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 C 36, 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: 1/2 inch, unless otherwise indicated.
 - 6. Thickness: 5/8 inch where indicated.
 - 7. Products: Subject to compliance with requirements, provide one of the following products where Type X gypsum wallboard is indicated:
 - a. "Gyprock Fireguard 'C' Gypsum Board"; Domtar Gypsum Co.
 - b. "Fire-Shield G"; Gold Bond Building Products Div., National Gypsum Co.
 - c. "SHEETROCK Brand FIRECODE 'C' Gypsum Panels"; United States Gypsum Co.
- C. Gypsum Backing Board for Multi-Layer Applications: ASTM C 442 or, where backing board is not available from manufacturer, gypsum wallboard, ASTM C 36, 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: 1/2 inch, unless otherwise indicated.
 - 6. Thickness: 5/8 inch where indicated.

- D. Water-Resistant Gypsum Backing Board: ASTM C 630, 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. Cement Board Ceiling: ASTM C 931, with manufacturer's standard edges, of type and thickness indicated below:
 - 1. Type: Regular, unless otherwise indicated.
 - 2. Thickness: 1/2 inch, unless otherwise indicated.
 - 3. Provide at ceilings of rooms indicated on drawings.

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:
 - b. "LC" Bead, unless otherwise indicated.
 - c. "L" Bead where indicated.
 - d. "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. Light Coves
 - 1. Material: Prefabricated high density gypsum reinforced with continuous filament glass fiber matt.

2. Provide Part No. LC151, 10'' long for Extended Learning Center, and Part No. LC160, 7 ½'' long for Media Center, office and skylight, all as manufactured by DECOFORM.

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 ASTM C 665 for Type I (blankets without membrane facing); and as follows:
 - 1. Mineral Fiber Type: Fibers manufactured from glass.
 - 2. Use in all partitions.

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.
- H. For exterior soffits provide cross-bracing and additional framing indicated or required to resist wind uplift.

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 where 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. Gypsum Board Application and Finishing Standard: Install and finish gypsum board to comply with ASTM C 840.
- B. Install sound attenuation blankets where indicated, prior to gypsum board unless readily installed after board has been installed.

- C. 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.
- D. 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.
- E. 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.
- F. 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.
- G. 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.
- H. 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.
- I. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.
- J. 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.
- K. Form control joints and expansion joints at locations indicated, with space between edges of boards, prepared to receive trim accessories.
- L. 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.
 3. Where partitions intersect open concrete coffer, cut gypsum board to fit profile of coffer and allow 1/4 to 1/2 inch wide joint for sealant.
- M. 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.
- N. 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.
- O. Space fasteners in gypsum boards in accordance with referenced gypsum board application and finishing standard and manufacturer's recommendations.

3.7METHODS 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. Wall Tile Base: Where drywall is base for thin-set ceramic tile and similar rigid applied wall finishes, install gypsum backing board.
1. In "dry" areas install gypsum backing board or wallboard with tapered edges taped and finished to produce a flat surface.

2. At showers, tubs and similar "wet" areas, install water-resistant gypsum backing board to comply with ASTM C 840 and recommendations of gypsum board manufacturer.
- C. 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.
- D. 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.
- E. Single-Layer Fastening Methods: Apply gypsum boards to supports as follows:
 1. Fasten with screws.
- F. 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.
- G. 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.
- H. Exterior Soffits and Ceilings: Apply exterior gypsum soffit board perpendicular to supports, with end joints staggered over supports. Install with 1/4 inch open space where boards abut other construction.
 1. Fasten with cadmium-plated screws, or with galvanized or aluminum nails where supports are nailable.

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.
- E. Finish exterior gypsum soffit board by using setting-type joint compounds to prefill joints, embed tape, and to apply first, fill (second) and finish (third) coats; smooth each coat before joint compound hardens to minimize need for sanding; sand between coats and after finish coat.
1. Painting of exterior gypsum soffit board after finish coat has dried is specified in Division-9 Section "Painting."
- F. 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.
- G. Water-Resistant Backing Board Base for Ceramic Tile: Finish joints between water-resistant backing board with tape and setting-type joint compound to comply with gypsum board manufacturer's recommendations and installation standards referenced in Division-9 Section "Tile."
- H. 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: (TILES)

A. Ceramic Tile-Mosaics:

1. Shall meet requirements of TCA 137.1 and requirements of this Section.
2. Ceramic tile shall be face mounted or back mounted at Contractor's option. If back mounted, it shall meet following requirements:
 - a. Mounting shall at least 66% of tile back to be free for contact and bonding to setting material.
 - b. Mounting shall be placed to allow at least 50% of any given joint between tile to be free for mechanical bonding to setting material.
 - c. Mounting shall not exceed 0.010" thick.
3. Ceramic tile shall be unglazed porcelain clay ceramic mosaics.

- a. 1" x 1" x 1/4" (floors) American Olean.
Acceptable alternate Cross Colors
Mosaics by Crossville (color to be
selected).
- b. Trim Shapes: As required to provide a
complete installation. Bull-nosed
exterior corners, 4" h coved based
units (with bull-nose cap where no wall
tile occurs).
- 4. Color ceramic tiles to be as selected by
Architect from American Olean, Crossville
colors or architecturally approved equivalent.
 - a. Floors - Unglazed radiants group.
- 5. Manufacturers, if in compliance with above:
 - a. American Olean
 - b. Florida Tile Company
 - c. U. S. Ceramic Company
 - d. Cross Colors - Crossville Ceramics

2.02 MARBLE THRESHOLDS

- A. First grade Group A, selected domestic marble of color
selected by the Architect. Marble thresholds shall have
exposed edge at door, beveled and ground smooth to level of
adjacent floor material.

2.03 SETTING MATERIALS

- A. Portland Cement Mortar Installation Materials: Provide
materials complying with ANSI A108.1A and as specified
below:
 - 1. Cleavage Membrane: Asphalt felt, ASTM D226, Type 1
(No. 15), or polyethylene sheeting ASTM D4397, 4.0
mils thick.
 - 2. Reinforcing Wire Fabric: Galvanized, welded wire
fabric, 2 by 2 inches by 0.062 inch diameter with ASTM
A185 and ASTM A82, except for minimum wire size.
- 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. American Olean, Lansdale, PA; "AO Dry-Set Mortar/AO Acrylic Dry-Set Mortar Additive".
 - b. Bonsal, Charlotte, NC; "Floor Thin Set Mortar/B-730 Acrylic Additive.
 - c. Bostik, Middletown, MA: Tile-mate 710/713/Hydroment 425
 - d. C-Cure, Houston, TX; Perma Bond 902/ANSI A118.4, Section F.2.1.2.
 - e. Laticrete, Bethany, CT; Laticrete 317/Laticrete 3701 Grout and Mortar mix.
 - f. Mapei, Elk Grove Village, IL; Keraset/Keraply
 - g. TEC, Palatine, IL; Thin Set Mortar 335/36/Full Bond

2.03 GROUTING MATERIALS

- A. Commercial Portland Cement Grout, complying with ANSI A118.6.
- B. Epoxy-Modified Grout Admixture: Complying with ANSI A118.8, at quarry tile locations.
 1. Provide one of the following manufacturers:
 - a. Bonsal, Charlotte, NC; B-800 Modified Epoxy Emulsion Mortar and Grout.
 - b. Bostik, Middletown, MA; Hydroment 1900 Epoxy-Modified Grout and Mortar Admixture.
 - c. C-Cure, Houston, TX; Epox Set 933.
- C. Color: Unless indicated otherwise; grout colors shall be as follows:
 1. Floors: Color shall be as selected by Architect.

2.07 MISCELLANEOUS MATERIAL

- A. Latex Underlayment: Quick set type, as recommended by membrane manufacturer, as required to provide positive drainage to floor drains.
- B. Mud-Set Method: Trowel applied waterproof membrane 9235 as manufactured by Laticrete International Inc.
- C. Sealer for Quarry Tile: Shall be a penetrating sealer as manufactured by Aqua Mix Inc., Santa Fe Springs, California, or Architect approved equivalent.

- D. 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 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.
- 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 1/16" joint.
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 (Mud-set Method): TCA F111 cement mortar with cleavage membrane complying with Tile Installation Specification ANSI A108.1.
- C. Walls
 1. Masonry (Cement Mortar Bond Method): TCA W211 cement mortar, bonded with Tile Installation Specification ANSI A108.1.

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.
- F. Grout all tile using commercial 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.
- 4. Before final inspection, remove protective coverings and rinse neutral cleaner from all tile surfaces.

END OF SECTION 09300

SECTION 09510 - ACOUSTICAL CEILINGS

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 acoustical panel ceiling is shown on the drawings and in schedules.

1.03 QUALITY ASSURANCE:

- A. Subcontract the installation of acoustical panel ceilings to an experienced installation firm which is acceptable to the manufacturer of the acoustical units, as shown by current written statement from the manufacturer.
- B. Standard for Terminology and Performance: Applicable publications by the Acoustical and Insulating Materials Association (AIMA), including "Performance Data, Architectural Acoustical Materials."
- C. Fire Hazard Classification: UL tested, listed and labeled as Class 0.25.

1.04 SUBMITTALS:

- A. Product Data:
 - 1. For information only, submit 2 copies of manufacturer's product specifications and installation instructions for each acoustical panel ceiling material required, and for suspension system, including certified laboratory test reports and other data as required to show compliance with these specifications. Distribute one additional copy of each installation instruction to the Installer.
 - a. Include manufacturer's recommendations for cleaning and refinishing acoustical panel, including precautions against materials and methods which may be detrimental to finishes and acoustical performance.

1.05 SAMPLES

1. Submit 3 sets of 12" square Samples for each acoustical panel required. In each set of samples show the full range of exposed color and texture to be expected in the completed work. Sample submittal and Architect's review will be for color and texture only. Compliance with other requirements is the exclusive responsibility of the Contractor.
2. Submit 3, 12" long samples of exposed runner and molding. Architect's review will be for color and texture only. Compliance with other requirements is the exclusive responsibility of the Contractor.

C. Maintenance Stock:

1. At the time of completing the installation, deliver stock of maintenance materials to the Owner. Furnish full size units matching the units installed, packaged with protective covering for storage and identified with appropriate labels. Furnish an amount equal to 5.0% of the amount installed.

1.06 JOB CONDITIONS:

- A. Space Enclosures: Do not install until interior acoustical panel ceilings unit space has been enclosed and is weather-tight, and until wet work in the space has been completed and is nominally dry and until work above ceilings has been completed, and until ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

PART 2 - PRODUCTS

2.01 CEILING UNITS: (Note: Only one manufacturer of ceiling tile is to be used throughout project).

- A. Acoustical Panels (ACT): (All locations except Concessions 06)
 1. Provide 24'' x 24'' wet formed high density mineral fiber units not less than $\frac{3}{4}$ '' thick, NRC 0.50, CAC 33 light reflectance over 87% square edge.

2. Acceptable Products:

- a. Armstrong: Item No. 861 ``Armatuff``
- b. CertainTeed: Item No. SB-157 ``School Board``
- c. USG: Item No. 56335 ``RockFace ClimaPlus Panels``

3. Install in 15/16" exposed tee system.

B. Acoustical Panels(WACT): (Use in Concessions 06).

- 1. Provide 24" x 24" wet-formed mineral fiber units not less than 3/4" thick, NRC 0.55, CAC 35, light reflectance 0.79, square edge.

2. Acceptable Products:

- a. Armstrong: Item No. 1715 ``Clean Room Mylar`` (field units) and No. 1720 ``Clean Room Mylar`` (border units - for use where panels must be cut on the jobsite).
- b. CertainTeed: Item No. 1172-CRF-1 ``VinylShield C-White CRF``
- c. USG: Item No. 56099 ``CleanRoom ClimaPlus Class 100``.

3. Install in 15/16" exposed tee grid.

2.02 CEILING SUSPENSION MATERIALS:

- A. General: Comply with ASTM C 635, as applicable to an intermediate duty suspension system. Coordinate with other work supported by or penetrating through the ceilings, including light fixtures and HVAC equipment.

- B. Attachment Devices: Size for 5 times the design load indicated in ASTM C 635, Table 1, Direct Hung.

- 1. Hanger Wires: Galvanized carbon steel, ASTM A 641, soft temper, prestretched, yield-stress load of at least 3 times design load but not less than 12 USWG.

- C. Exposed Suspension System: Exposed systems compatible with tiles specified and as follows:

- 1. Armstrong - 15/16" prelude exposed tee grid.
- 2. CertainTeed - 15/16" Classic Aluminum Capped Stab System.
- 3. Donn - DX Series

- F. Edge Moldings: Manufacturer's standard channel molding for grid type used for edges and penetrations of ceiling, with a single flange of molding exposed, finish to match grid.

2.03 MISCELLANEOUS MATERIALS:

- A. Acoustical Sealant: A heavy-bodied, non-shrinking, non-drying, non-sag grade mastic compound intended for interior sealing of concealed construction joints.
- B. Tile Cement: As recommended by tile manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION WORK:

- A. Installer must examine the conditions under which the acoustical ceiling work is to be performed and notify the Contractor, in writing, of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
- B. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid the use of less-than-half widths units at borders, and comply with reflected ceiling plans wherever possible.

3.02 INSTALLATION:

- A. General: Install material in accordance with manufacturer's printed instructions and comply with governing regulations as indicated, and industry standards applicable to the work.
- B. Install suspension systems to comply with ASTM C 636 with hangers supported only from building structural members as indicated. Locate hangers near each end and spaced 4' - 0' along direct-hung runners, unless otherwise indicated.
 - 1. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eye-screws, or other devices which are secure and appropriate for the substrate, and which will not deteriorate or fail with age or elevated temperatures.

- C. Install edge moldings at edges of each acoustical ceiling area and at locations where edge of units would otherwise be exposed after completion of the work, except where adhesively applied.
 - 1. Sealant Bed: Apply continuous ribbon of acoustical sealant, concealed pm back of vertical leg before fastening to vertical surface.
 - 2. Secure moldings to building construction by fastening with screw-anchors into the substrate through holes drilled in not more than 16" o.c. along each molding.
 - 3. Level moldings with ceiling suspension system to level tolerance of 1/8" in 12' - 0".
 - 4. Miter corners of moldings accurately to provide hair-line joints, securely connected to prevent dislocation.
- D. Cope exposed flanges of intersection suspension system members so that flange faces will be flush (cope flange of member supported by other member) except as otherwise indicated.
- E. Install acoustical panels in coordination with suspension system, with edges concealed by support of suspension members. Scribe and cut panels to fit accurately at penetrations.
- F. Install edge trim moldings where indicated and elsewhere as needed to conceal edges of acoustical units which would otherwise be exposed to view after completion of the work. Anchor with fasteners, or if not possible, secure in place with permanent adhesive.

3.03 CLEANING AND PROTECTION:

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work which cannot be successfully cleaned and required to permanently eliminate evidence of damage.
- B. The Installer shall advise the Contractor of required protection for the acoustical panel ceilings, including temperature and humidity limitations and dust control, so that the work will be without damage and deterioration at the time of acceptance by the Owner.

END OF SECTION 09510

MELVINDALE-NORTHERN ALLEN PARK PUBLIC SCHOOLS

STADIUM RENOVATION at

MELVINDALE HIGH SCHOOL

171739

DECEMBER 18, 2017

SECTION 09540 - SPECIAL SURFACES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work described in this section:
 - 1. Window Sills (indicated as synthetic sill material on drawings).
- B. Related work specified elsewhere:
 - 1. Section 06100 - Carpentry
 - 2. Section 09250 - Gypsum Drywall

1.02 REFERENCES

- A. Applicable Standards: Standards of the following, as referenced herein:
 - 1. American National Standards Institute (ANSI)
 - 2. American Society for Testing and Materials (ASTM)
 - 3. National Electrical Manufacturers Association (NEMA)
 - 4. Federal Specifications (FS)

1.03 SUBMITTALS

- A. Shop drawings: Indicate dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.
- B. Samples: Submit minimum 2" x 2" (50mm x 50mm) samples. Indicate full range of color and pattern variation. Approved samples will be retained as standards for work.
- C. Product data: Indicate product description, fabrication information and compliance with specified performance requirements.
- D. Maintenance data: Submit manufacturer's care and maintenance data, including repair and cleaning

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instructions. Include in project close-out documents.

1.04 QUALITY ASSURANCE

- A. Allowable tolerances:
 - 1. Variation in component size: $\pm 1/8"$ (3 mm).
 - 2. Location of openings: $\pm 1/8"$ (3 mm) from indicated location.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver no components to project site until areas are ready for installation. Store components indoors prior to installation.
- B. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.06 WARRANTY

- A. Provide manufacturer's 10 year warranty against defects in materials. Warranty shall provide material and labor to repair or replace defective materials. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.

PART 2 - PRODUCTS

2.01 SOLID POLYMER FABRICATIONS

- A. Material: Homogeneous filled acrylic; not coated, laminated or of composite construction; meeting ANSI Z124.3 & .6, Type Six, and Fed. Spec. WW-P-541E/GEN.
 - 1. Material shall have minimum physical and performance properties specified in the following Section U.
 - 2. Superficial damage to a depth of 0.010" (.25mm) shall be repairable by sanding

and polishing.

B. Manufacturer:

1. Corian (Basis of Design)
2. Newmar
3. Gibraltar
4. Avonite
5. Prism as manufactured by InPro Corp.

C. Windowsills (pre-finished sills): ½" thick solid polymer, as shown on drawings, adhesively joined with inconspicuous seams; edge details as indicated on the Architects drawings. Color to be selected by Architect from manufacturer's standard and/or custom colors from all price groups.

2.02 ACCESSORY PRODUCTS

- A. Joint adhesive: Manufacturer's standard two-part adhesive kit to create inconspicuous, non-porous joints, with a chemical bond.
- B. Sealant: Manufacturer's standard mildew-resistant, FDA/UL recognized silicone sealant in color matching or clear formulations.

2.03 FABRICATION

- A. Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's requirements.
- B. Form joints between components using manufacturer's standard joint adhesive. Joints shall be inconspicuous in appearance and without voids. Attach 2" (50 mm) wide reinforcing strip of solid surface under each joint.
- C. Rout and finish component edges to a smooth, uniform finish. Rout all cutouts, then sand all

edges smooth. Repair or reject defective or inaccurate work.

D. Finish: All surfaces shall have uniform finish.

1. Matte, with a gloss rating of 5-20.

E. Thermoforming: Comply with forming data from manufacturer.

1. Construct matching molds of plywood to form component shape.

2. Form pieces to shape prior to seaming and joining.

3. Cut pieces larger than finished dimensions. Sand edges. Remove all nicks and scratches.

4. Heat entire component uniformly between 275°F-325°F during forming.

5. Prevent blistering, whitening and cracking of solid surface during forming.

PART 3 - EXECUTION

3.01 JOB MOCK-UP

A. Prior to final approval of shop drawings, erect one full size mock-up of each component at project site for Architect review.

B. Should mock-up not be approved, rework or remake until approval is secured. Remove rejected units from project site.

C. Approved mock-ups shall remain as part of finished work.

3.02 INSTALLATION

A. Install components plumb and level, in accordance with approved shop drawings and product installation details.

B. Form field joints using manufacturer's recommended

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adhesive, with joints inconspicuous in finished work. Keep components and hands clean when making joints.

- C. Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Components shall be clean on Date of Substantial Completion.
- D. Protect surfaces from damage until Date of Substantial Completion. Repair or replace damaged work that cannot be repaired to Architect's satisfaction.
- E. Fabricator/Installer is to provide manufacturers recommended manuals, and review maintenance procedures and the manufacturer's warranty with the head of Maintenance upon completion of the project.

END OF SECTION 09540

SECTION 09900 - PAINTING

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 painting work is shown on the drawings and schedules, and as herein specified.
- 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.

1.03 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.

1.04 SUBMITTALS:

A. Product Data:

1. For information only, submit 2 copies of manufacturer's technical information including paint label analysis and application instructions for each materials proposed for use. Transmit a copy of each manufacturer's instructions to the paint Applicator.

B. Samples:

1. Submit samples for Architect's review of color and texture only. Compliance with all other requirement is the Exclusive responsibility of the Contractor. Provide a listing of the materials and application for each coat of each finish sample.
 - a. On 12" x 12" hardboard, provide two samples of each color and material with texture to simulate actual conditions. Resubmit each samples as requested until acceptable sheen, color and texture is achieved.
 - b. On actual wood surfaces, provide two 4" x 8" samples of each stained wood finish as required. Label and identify each as to location and application.

1.05 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.

1.06 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 exceed 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

2.01 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 and will be based on Benjamin Moore. 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.
 3. Unless noted otherwise, painted drywall is to have semi-gloss finish.

- 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.

2.03 EXTERIOR PAINT SYSTEMS:

- A. Metal-Galvanized (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.
S-W: (2 coats) DTM Acrylic Coating, B66W200.
PPG: (2 coats) Pitt-TechJ One Pack DTM Waterborne Satin Enamel #90-474 Series.
Standard: A-7065 Stanocryl Semi-Gloss Enamel
- B. Metal - Heat Resistant: (Maximum Temperature 1,000 degrees F.) (VOC 650)
 - 1. Primer: Silicone Alkyd, .75 mils DFT/coat.
S-W: Silver-Brite Hi-Heat Silicone Alkyd Aluminum, B59S8.
PPG: Speedhide7 High Heat Resistant Aluminum Paint #6-220
Standard: 07S High Temperature Resistant Silicone Aluminum
 - 2. Finish Coats: Silicone Alkyd, Aluminum Bright, .75-1.0 mils DFT/coat.
S-W: (1 coat) Silver-Brite Hi-Heat Silicone Alkyd Aluminum, B59S8.
PPG: (1 coat) Speedhide7 High Heat Resistant Aluminum Paint #6-220
Standard: 07S High Temperature Resistant Aluminum

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)

D. Standing Seam Metal Roof and Fascia:

1. Surface Prep: Power wash with sand injection to
provide a minimum 1.0 mil profile. Areas of
corrosion should be cleaned to meet SSPC-SP11
Power Tool Cleaning to Bare Metal.
2. Spot Prime: Tnemec Series 135 Chembuild at 4.0-6.0
mils DFT.
3. Intermediate: Tnemec Series 135 Chembuild at 4.0-
6.0.
4. Finish: Tnemec Series 1072 Fluoronar at 2.0-3.0
mils DFT.

2.04 INTERIOR PAINTING SCHEDULE:

A. Concrete Masonry Surfaces (Semi-Gloss)(Vinyl Acrylic Latex System)

1. Primer: Vinyl Acrylic Block Filler
S-W: ProMar Interior/Exterior Block Filler,
B25W25.
PPG: Aquapon7 WB Polyamide-Epoxy (self-priming on
floors) #98-Line Series
Standard: A-7012 Interior/Exterior Latex Block
Filler
2. Finish Coats: Vinyl Acrylic Semi-Gloss Enamel (25-
35 units at 60 degrees F.), 1.5 DFT/coat.
S-W: (2 coats) ProMar 200 Interior Latex Semi-
Gloss Enamel, B31W200.
PPG: (1 coat) Aquapon7 WB Polyamide-Epoxy #98 -
Line Series
Standard: A-7010 Stanaglo Latex Semi-Gloss

B. Concrete Masonry Surfaces (Semi-Gloss): (Water Based Epoxy - Normal Exposure)

1. Primer: 100 percent Acrylic Resin Block Filler,
.075 - 1.0 DFT/coat.
S-W: Heavy Duty Block Filler, B42W46.

PPG: Speedhide7 Latex Masonry Block Filler #6-7
Standard: A-7012 Interior/Exterior Latex Block Filler

2. Finish Coats: Water Based Epoxy, Semi-Gloss (20-30 units at 60 degrees F.) 3 mils DFT/coat.
S-W: (2 coats) Water Based Catalyzed Epoxy, B70/B60V25.
PPG: (2 coats) Pitt-Glaze7 High Solids Semi-Gloss Acrylic-Epoxy #16-900 Series
Standard: (2 coats) Hydro-Glaze Water Based Epoxy

C. Metal-Ferrous (Semi-Gloss): (Alkyd Enamel System, Maximum VOC content 450 grams/liter)

1. Primer: Modified Alkyd Resin Primer, 3 mils DFT/coat
S-W: Kem Kromik Universal Metal Primer, B50Z
PPG: Speedhide7 Inhibitive Primer #6-208 red or #6-212 white
Standard: Hydro-Prime

2. Finish Coats: Alkyd Enamel, Semi-Gloss (40-50 units at 60 degrees F.) 3.0 mils DFT/coat.
S-W: (2 coats) Alkyd Enamel, Semi-Gloss B34W200.
PPG: (2 coats) Speedhide7 Alkyd Semi-Gloss #6-1110 Series
Standard: A-7067 Workrite Vinyl Acrylic Semi-Gloss

D. 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.
S-W: (2 coats) DTM Acrylic coating, B66W200.
PPG: (2 coats) Pitt-TechJ Open Pack DTM Waterborne Satin Enamel #90-474 Series
Standard: A-7010 Stanoglo Semi-Gloss Enamel

E. Gypsum Board (Semi-Gloss): (Acrylic Latex System) Use unless specifically noted otherwise.

1. Primer: Vinyl Acrylic Latex, 1.1 mils DFT/coat
S-W: ProMar 200 Latex Wall Primer, B28W200.
PPG: Speedhide7 Latex Primer-Sealer #6-2
Standard: A-7013 Vinyl Primer

2. Finish Coats: Vinyl Acrylic Semi-Gloss (25-35 units at 60 degrees F.), 1.5 mils DFT/coat.
S-W: (2 coats) ProMar 200 Semi-Gloss Enamel, B31W200.
PPG: (2 coats) Speedhide7 Acrylic Latex Semi-Gloss Enamel #6-510 Series
Standard: A-7010 Stanoglo Semi-Gloss Enamel

G. Gypsum Board (Semi-Gloss): (Water Based Epoxy System)

1. Primer: Vinyl Acrylic Latex, 1.1 mils DFT/coat
S-W: ProMar 200 Latex Wall Primer, B28W200.
PPG: Speedhide7 Latex Primer-Sealer #6-2
Standard: A-7013 Vinyl Primer
2. Finish Coats: Water Based Catalyzed Epoxy, Semi-Gloss (20-30 units at 60 degrees F.), 2.5 - 3.0 mils DFT/coat.
S-W: (2 coats) Water Based Catalyzed Epoxy, P60V25.
PPG: (2 coats) Pitt-Glaze 7 High Solids Semi-Gloss Acrylic-Epoxy #16-900 Series
Standard: Hydro-Glaze Water Borne Epoxy

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

3.01 INSPECTION:

- A. Applicator must examine the areas and conditions under which painting work is to be applied 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

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.

3.02 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.
- 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.

E. Galvanized Surfaces:

1. Clean free of oil and surface contaminants with an acceptable non-petroleum based solvent.

3.03 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.

3.04 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 deform 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 the 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, orange-peel, 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.

3.05 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

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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 10100 - CHALKBOARDS, MARKERBOARDS AND TACKBOARDS

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 chalkboards, markerboards and tackboards is shown on the drawings.
- B. The types of boards required include the following:
 - 1. Vinyl-faced tackboards.
 - 2. Porcelain enamel dry markerboards.

1.03 QUALITY ASSURANCE:

- A. Fire Hazard Classification: Provide materials bearing UL label and marking indicating fire hazard classification of marking and tack surfaces, as determined by ASTM E 84 and as follows.
 - 1. Flame spread not more than 25.
 - 2. Fuel contributed not more than 35.
 - 3. Smoke developed not more than 50.
- B. In addition to the requirements of these specifications, comply with manufacturer's instructions and recommendations for all phases of the work, including preparation of substrate, installation of grounds and anchors, and application of materials.
- C. Provide colors of material for marking chalkboards, markerboards and tackboards as selected by the Architect from manufacturer's standard colors.
- D. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible to ensure proper fitting of the work. However, do not delay job progress; allow for trimming and fitting wherever the taking of field measurements before fabrication might delay the work.

1.04 SUBMITTALS:

A. Product Data:

1. For information only, submit 4 copies of manufacturer's technical data and installation instructions for each material and component part. Include methods of installation for each type of substrate to receive units. Transmit copy of each instruction to the Installer.

B. Samples:

1. Submit 4 sets of samples for each color of chalkboard, markerboard and tackboard, trim, and accessories required. Provide 12" square samples of sheet materials and 12" lengths of trim members. Architect's review of samples will be for color, pattern, and texture only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

C. Shop Drawings:

1. Submit shop drawings for chalkboard, markerboard and tackboard units. Include full-scale sections of typical trim members and dimensioned elevations. Show anchors, ground reinforcement, accessories, and installation details.

PART 2 - PRODUCTS

2.01 MARKERBOARD:

A. LCS Liquid Chalk Porcelain Enamel Writing Surface.

1. Porcelain enamel finish on 24 gauge steel.
2. Core: 1/4" hardboard.
3. Backing Sheet: 0.005" thick aluminum foil.

B. Manufacturer:

1. Polyvision
2. Integrated Interiors Inc.

2.02 TRIM AND ACCESSORIES:

- A. General: Fabricate frames and trim of not less than 0.062" thick aluminum alloy, size as shown to suit type of installation. Provide straight, single-length units wherever possible and keep joints to a minimum. Miter corners to a neat, hairline closure. Furnish exposed aluminum trim, accessories, and fasteners with satin anodized finish AA-M31A31, unless otherwise indicated.
 - 1. Except as otherwise indicated; provide manufacturer's standard "narrow" trim units, approximately 1/2" wide.
 - 2. When structural support accessories are required for chalkboards, markerboards and tackboards in addition to normal trim, provide such additional support or modify trim as required to provide necessary support.
 - a. Provide snap-on trim with no visible screws or exposed joints.
- B. Chalktrough: Furnish continuous aluminum chalktrough for each chalkboard, and markerboard unless otherwise indicated as follows:
 - 1. Solid extrusion, manufacturer's standard ribbed section.

2.03 FABRICATION:

- A. Provide factory-assembled chalkboards, markerboards and tackboards.
- B. All boards are to be 4' in height in lengths indicated on plans. Boards are to be wall mounted in a stationary position not on wall standards.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Installer must examine the areas and conditions under which 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 boards in locations and mounting heights as shown on the drawings and in accordance with the manufacturer's instructions. Provide all grounds, clips, backing materials, brackets, and anchors for a complete installation.
- B. Deliver factory-built chalkboard, markerboard and tackboard units completely assembled in one piece without joints, whenever possible. Where dimensions exceed panel size, provide 2 or more pieces of equal length, as acceptable to the Architect. When overall dimensions require delivery in separate units, prefit at the factory, disassemble for delivery, and make final joint at the site. Use splines at joints to maintain surface alignment and smooth joints.
- C. Install units with concealed hangers plumb and level, in accordance with the manufacturer's printed instructions.
- D. Coordinate job-assembled units with grounds, trim, and accessories. Join all parts with neat, precision fit.

END OF SECTION 10100

SECTION 10160 - TOILET PARTITIONS

PART 1 - GENERAL

1.01 SUBMITTALS:

- A. Plastic compartment work includes the following, where indicated:
 - 1. Floor mounted overhead-braced compartments.
- B. Furnish all labor and materials necessary for the completion of work in this section as shown on the contract drawings and specified herein.
- C. Work in this section shall include, but is not limited to:
 - 1. Toilet compartments, compartment doors.
 - 2. Hardware for toilet compartments.
 - 3. Shop drawings and working drawings.
 - 4. Manufacturer's guarantee/warranty.
- D. Related work specified elsewhere shall include accessories and anchorage/blocking for attachment of partitions.

1.02 PRODUCT:

- A. Submit six (6) sets of shop drawings and details for Architect's approval.
- B. Colors shall be selected from the manufacturer's full range of colors.
- C. Submit 6'' square color samples of each color and hardware samples for approval by the Architect.

PART 2 - PRODUCTS

2.01 MANUFACTURER:

- A. Provide toilet partitions and screens by one of the following manufacturer's:
 - 1. SCRANTON PRODUCTS (Santana/Comtec/Capitol) Scranton, PA.
 - 2. Legacy Polymer Products, Inc., Poly Series, Dunmore, PA.
 - 3. AMPCO Products, LLC, Solid Plastic Polyethylene, Miami, FL.
 - 4. Bradmar; Bradley Corp.
 - 5. General Partitions.
 - 6. Global Partitions

2.02 MATERIALS:

- A. Doors, panels, pilasters and privacy screens and supports shall be 1'' thick constructed from High-Density Polyethylene (HDPE) resins. Partitions and privacy screens shall be fabricated from polymer resins compounded under high pressure, forming a single component which is waterproof, nonabsorbent and has a self-lubricating surface that resists marks from pens, pencils, markers and other writing instruments. All plastic components shall be covered with a protective plastic masking.

2.03 CONSTRUCTION:

- A. Doors, panels, pilasters and privacy screens shall be 1'' thick with all edges rounded to a ¼'' radius.
- B. Doors and dividing panels shall be 55'' high and mounted at 14'' above the finished floor. Fasten an aluminum heat sink to the bottom edges.
- C. Pilasters shall be 82'' high (standard) and fastened into a 3'' high pilaster shoe with a stainless steel, torx head sex bolts.

2.04 HARDWARE:

- A. Door hardware shall be as noted:
 - 1. Hinges shall be integral, fabricated from the door and pilaster with no exposed metal parts, adjustable in 30 degree increments to hold door open up to 90 degrees.
 - 2. Door strike/keeper shall be 6'' long and made of heavy-duty extruded aluminum (6436-T5 alloy) of either an anodized finish or a bright dipped anodized finish, with wrap around flanges and secured to the pilasters with stainless steel, torx head sex bolts. Bumper shall be made of extruded black vinyl.
 - 3. Latch and housing shall be made of heavy-duty extruded aluminum (6463-T5 alloy). The latch housing shall have either an anodized finish or a bright dipped anodized finish, and the slide bolt and button shall have a black anodized finish.
 - 4. Each door shall be supplied with one coat bumper/hook and 2 door pulls made of chrome plated zamak. Outswing doors shall be supplied with a door stop made of chrome plated zamak.

- B. Plaster shoes shall be 3'' high (type 304, 20 gauge) stainless steel. Pilaster shoes shall be secured to the pilaster with a stainless steel, torx head sex bolt.
- C. Wall brackets for partitions shall be 1½'' stirrup type made of heavy-duty aluminum (6463-T5 alloy) with either an anodized or a bright dipped anodized finish. Stirrup brackets shall be fastened to pilasters and panels with stainless steel, torx head sex bolts.
- D. Headrail shall be made of heavy-duty extruded aluminum (6463-T5 alloy) with anti-grip design and integrated curtain track. The headrail shall have an anodized finish and shall be fastened to the headrail bracket by a stainless steel, torx head sex bolt, and fastened to the top of the pilasters with stainless steel, tamper resistant torx screws.
- E. Headrail brackets shall be of heavy duty extruded aluminum with an anodized finish or 20 gauge stainless steel with a satin finish, and secured to the wall with #14 stainless steel screws.

PART 3 - EXECUTION

3.01 PREPARATION:

- A. Examine areas to receive toilet partitions/compartments for correct height and spacing of anchorage/bolting and plumbing fixtures that may affect installation of partitions/compartments. Report any discrepancies to the Architect and Construction Manager.
- B. Take complete and accurate measurements of complete toilet compartment locations.
- C. Start of work constitutes acceptance of job.

3.02 INSTALLATION:

- A. Install partitions rigid, straight, plumb, and level, with plastic laid out as shown on shop drawings and manufacturer's installation instructions.
- B. All doors and panels to be mounted at 14'' above finished floor.
- C. Clearances at vertical edges of doors shall be uniform top to bottom and shall not exceed 3/8''.

- D. Clearances at pilasters and panels shall be uniform top to bottom and shall not exceed $\frac{1}{2}$ "
- E. Clearances between panels and walls shall be uniform top to bottom and shall not exceed 1".
- F. No evidence of cutting, drilling, and/or patching shall be visible on the finished work.
- G. Finished surface shall be cleaned after installation and be left free of all imperfections.

3.03 WARRANTY:

- A. Submit manufacturer's standard guarantee for HDPE plastic against breakage, corrosion, and delamination under normal conditions for 15 years from the date of receipt by the customer. If materials are found to be defective during that period for reasons listed above, the materials will be replaced free of charge. (Labor not included in warranty).

END OF SECTION 10160

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 with flanges on all sides to secure to wall surfaces.
- 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 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 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. Restore 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 Building Signage
 - 3. Exterior Acrylic Logo Sign

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. Manufacturers: (Exterior Pin Mounted Building Signage) Subject to compliance with requirements, provide signage by one of the following:
 - 1. Metal Arts Division of L & H Manufacturing Company, Mandan, North Dakota
 - 2. Other Architect approved equal.
- C. 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 EXTERIOR ACRYLIC LOGO SIGN:

- 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: 1/4 inch.
 - 2. Colors as specified.
 - 3. Camera ready artwork of logo to be supplied by Owner.
- 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 see plans for sizes.

- B. Interior Room Name and Number Signs
 - 1. Layout of room name and number shall be as directed by the Architect.
 - 2. Number of signs required:
 - a. Refer to Rooms indicated on Signage Schedule on Drawings:

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 and style are as indicated on the drawings.
- C. Cast bronze individual letters (#60 oxidized bronze).
- D. Provide letters based on Metal Arts Metal Letters - Phone: (1-800-237-8069) or equal.
- E. Provide 8" H lettering as follows: Exact locations and font styles to be determined.
 - 1. Cardinal Stadium

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.

3.02 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 10500 - METAL LOCKERS

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 metal lockers is shown on the drawings and is generally as follows:
 - 1. 18"w x 18"d x 72"h double tier heavy duty athletic room locker.
Quantity: HOME 02 = 30 frames (60 lockers)
Quantity: VISITOR 05 = 30 frames (60 lockers)
 - 2. 12"w x 12"d x 72"h double tier heavy duty athletic room locker.
Quantity: COACH 01 = 8 frames (16 lockers)
Quantity: COACH 07 = 8 frames (16 lockers)

1.03 QUALITY ASSURANCE:

- A. Provide metal lockers as a complete unit produced by a single manufacturer, including necessary mounting accessories, fittings, and fastenings.
- B. Manufacturer: Provide metal lockers as manufactured by Republic Steel Corporation or other as approved by Owner.

1.04 SUBMITTALS:

- A. Manufacturer's Data:
 - 1. For information only, submit two (2) copies of manufacturer's technical data and installation instructions for the metal locker units. Transmit a copy of each instruction to installer.
- B. Samples:
 - 1. Submit three (3) samples, on metal, of each color and finish that are required for lockers. Review 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 metal lockers, verifying dimensions affecting locker installations. Show lockers in detail, method of installation, fillers, trim, base and accessories. Include locker numbering sequence information.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Do not deliver metal lockers until building is ready for their installation. Protect from damage during delivery, handling, storage and installation.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Sheet Steel: Cold-rolled steel for doors and door frames. Cold-rolled steel or annealed, specially treated steel for other parts. All steel free from buckle, scale and surface imperfections.
- B. Fasteners: Cadmium, zinc or nickel plated steel. Exposed bolt heads, slotless type. Provide self-locking nuts or lock washers for nuts on moving parts, or otherwise prevent loosening of nuts. Do not expose bolts or rivet heads on fronts of lockers or frames.
- C. Equipment: Furnish hooks and hang rods of zinc-plated steel, formed with ballpoints and attached with two bolts or rivets.

2.02 LOCKERS:

- A. Door Frames: Shall be 16 gauge formed into deep, 1'' face channel shapes with a continuous vertical door strike integral with the frame on both sides of the door opening. Double, triple or four tier locker cross frame members shall be 16 gauge channel shaped securely welded to vertical framing members to ensure a square and rigid assembly.
- B. Body: The body of the locker shall consist of 24 gauge upright sheets, backs, tops, bottoms and shelves. Tops, bottoms and shelves shall be flanged on all four sides; backs are flanged on two sides. Uprights shall be offset at the front and flanged at the rear to provide a double lapped rear corner.

- C. Handles: A non-protruding 14 gauge lifting trigger and slide plate shall transfer the lifting force for actuating the lock bar when opening the door. The exposed portion of the lifting trigger shall be encased in a molded ABS thermoplastic cover that provides isolation from metal-to-metal contact and be contained in a formed 20 gauge stainless steel recessed pocket. This stainless steel pocket shall contain a recessed area for the various lock types available and a mounting area for the number plate.
- D. Pre-Locking Device: All "tiered" lockers shall be equipped with a positive automatic pre-locking type, whereby the locker may be locked while door is open and then closed without unlocking and without damaging locking mechanism.
- E. Doors: Doors shall be 16 gauge or 18 gauge steel for short or narrow doors as required by manufacturer's design, formed with a full channel shape on lock side to fully conceal the lock bar, channel formation on the hinge side and right angle formation across the top and bottom. Single tier doors 60'' and 72'' in height and 18'' and wider shall have a diagonal reinforcing angle welded to the inner surface. Ventilation consists of full perimeter opening.
- F. Hinges: Hinges shall be 2'' high, 5-knuckle, full loop, tight pin style, securely welded to frame and double riveted to the inside of the door flange. Locker doors 42'' high and less shall have two hinges. Doors over 42'' high shall have three hinges.
- G. Latching: Latching shall be one-piece, pre-lubricated, spring steel latch completely contained within the lock bar under tension to provide rattle-free operation. The lock bar shall be securely contained in the door channel by self-lubricating polyethylene guides that isolate the lock bar from metal-to-metal contact with the door. There shall be three latching points for lockers over 42" in height and two latching points for all tiered lockers 42" and under in height. The lock bar travel is limited by contacting resilient elastomeric cushioning devices located inside the lock bar. Frame hooks to accept latching shall be of heavy gauge steel, set close in and welded to the frame. Continuous vertical door strike shall protect frame hooks from door slam damage. The impact caused by the door closing shall be absorbed by a soft rubber silencer which is to be securely installed on each frame hook.

2.03 LOCKER ACCESSORIES:

- A. Locking: Supply with recessed cup to receive padlock.
(Locks provided by owner)
- B. Equipment:
 - 1. All lockers to have one shelf and one double prong and three single prong coat hooks.
- C. Number Plates: Each locker shall have a polished aluminum number plate with black numerals not less than 1/2'' high. Plates shall be attached with rivets to the lower surface within the recessed handle pocket. Numbering to be determined by owner.
- D. Tops:
 - 1. Provide continuous heavy duty 4'' slope top on all lockers.
- E. Base: Install on concrete base in rooms 02 and 05, (Provided by others) Install on metal base in rooms 01 and 07 provided by locker manufacturer.
- F. Trim: Provide fillers at sides and top as shown or required.
- G. End Panels: Provide finished end panels on all exposed ends.
- H. Construction: Fabricate lockers square, rigid and without warp with metal faces flat and free of dents or distortion. Make all exposed metal edges safe to the touch. Weld frames together. Weld, bolt, or rivet other joints and connections as standard with manufacturer. Grind exposed welds flush.
- I. Finishing: Chemically pretreat metal with degreasing and phosphatizing process. Apply baked-on enamel finish to all surfaces, exposed and concealed, except plates and non-ferrous metal. Architect will select from manufacturer's standard colors. Color of frame will be different than color of door.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Installer must examine the areas and conditions under which metal wardrobe lockers 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 metal lockers at the locations shown in accordance with the manufacturer's instructions for a plumb, level, rigid, and flush installation.
- B. Space fastenings about 48" O.C. and apply through back-up reinforcing plates where necessary to prevent metal distortion. Conceal all fasteners wherever possible.
- C. Install trim, metal channel base, and sloping top units where indicated to provide a flush, hairline joint against adjacent surfaces. Install with concealed fasteners.
- D. Touch-up marred finishes, or replace if not acceptable to the Architect. Use only materials and finishes as recommended or furnished by the locker manufacturer.
- E. Adjust doors and latches to operate easily without bind. Verify satisfactory operation of integral locking devices.
- F. Where required, provide metal filler panels for closure to adjacent surfaces, factory-finishes to metal lockers.

END OF SECTION 10500

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 by the Owner and installed by the Owner, include the following:
 - 1. Soap dispenser
 - 2. Paper Towel Dispensers
 - 3. Toilet tissue dispensers
- C. The type of toilet accessories to be provided and installed by the Contractor include the following:
 - 1. Mirrors
 - 2. Grab bars
 - 3. Misc. Accessories

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 Dispenser Company, Inc.
 2. Accessory Specialties.
 3. Bradley Corporation
 4. Bobrick
 5. Moore Dispensers, Inc.
 6. The Charles Parker Company
 7. Ponoco Metal Products Company
 8. Watrus, Inc.

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, where indicated.
- G. Stainless Steel Mirror Surfaces, where noted: Not less than 0.04 inch (209 gauge) AISI type 302/304 stainless steel sheet, stretcher leveled with No. 8 polished mirror finish. Bond to 1/4 inch minimum hardboard backing.
- H. Galvanized Steel Mounting Devices: ASTM A153, hot-dip galvanized after fabrication.
- I. Fasteners: Screws, bolts, and other devices of same material as accessory unit, or of galvanized steel where concealed.

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 jacking 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
2. Provide sizes indicated on plans
3. Mount mirrors at 40'' from finish floor to bottom edge of GLASS (not frame)

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. Provide sizes and locations as indicated on plans.
3. Mount in accordance with current Michigan Building Code and ANSI regulations.

2.04 MISCELLANEOUS ACCESSORIES

A. Trapwrap

1. Provide trapwrap at all exposed plumbing under wall mounted sinks. Verify quantities in field.
2. Trapwrap to be as manufactured by Brocar Products Inc. or TrueBro.

B. 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.

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 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.
- D. 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.
- G. Schedule: See Drawings

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. Dedication plaque
 - 2. Storage mesh partitions
 - 3. Vertical Plastic Corner Guards

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:
 - Board of Education members and titles
 - School District Superintendent, Architect, Construction Manager and Titles
 - Date
 - Building Name
 - Name of School District

B. Storage Mesh Partitions

1. Provide 10-gauge, wire mesh partitions in 5' wide sections by 9' high in areas indicated on plans as manufactured by Acorn Wire & Iron Woks Model NO. 130A (800)552-2676.
2. Provide total lengths as indicated on plans.

C. Vertical Plastic Corner Guards

- a. Acrovyn 4000 series, Model #SSM-20N. Corner guard and backer piece. Color to be determined from standard color range.
- b. Provide 48" long guard at each exposed corner (2 required). Cut to fit in field.
- c. www.c-sgroup.com/acrovyn/corner-guards

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 Construction Manager 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 12300 - PLASTIC LAMINATE CASEWORK

PART 1 - GENERAL

1.01 General Provisions

- 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 other sections, divisions, and schedules for work in connection with this section.

1.02 Intent

- A. The intent of this specification is to establish minimum performance and quality criteria consistent with preestablished standards of design and function. Casework not meeting these minimum requirements will be unacceptable.
- B. The casework contractor shall be held in strict compliance with any specific materials, finishes, construction details and hardware that are specified herein. Bids proposing to supply casework not meeting these requirements will be rejected.

1.03 Work Included

- A. Furnish, deliver, and install to Owner's and Architect's satisfaction, all prefabricated plastic laminate casework as shown on drawings, schedules and equipment lists.
- B. Furnish and install all fillers, scribes, finished ends, finished backs, work surfaces/backsplashes, and cutouts required to provide a complete and finished project. Plastic laminate work surfaces shall include backer sheet.
- C. Provide sinks and fittings, electrical outlets and fixtures when specifically stated as being part of this contract.
- D. Provide locks on all tall storage, wardrobe cabinets and at all low cabinets, and upper wall cabinets unless noted otherwise. All cabinets are to be keyed alike per room. All locks are to be masterkeyable to room doors.

- E. Installation, connection, and testing of all sinks, fittings, electrical fixtures; providing all rough-ins: mechanical piping, electrical runs, and connections required for a complete project.
- F. Blocking, framing, and reinforcement in walls, ceilings, and floors for anchoring of cabinets and trim.

1.05 QUALIFICATIONS

- A. Plastic laminate casework shall be as manufactured by Stevens Cabinet Co. Division of Stevens Industries Inc., Teutopolis, Illinois. Products and catalog numbers are from Stevens catalog and are used as basis for identification, configuration, size and quality.
- B. Other pre-approved manufacturers are as follows:
 - TMI System Design Corp. Dickinson, North Dakota
 - Case Systems Inc., Midland, Michigan
 - LSI Corporation of America, Inc., Minneapolis, Minnesota
 - Polyvision Corporation, www.polyvision.com, Suwanee, Georgia
 - Fisher Hamilton, Two Rivers, Wisconsin
 - Wood Metal Casework
 - Mica-Tec, Inc.
- C. Casework of other manufacturers will be considered for approval providing written request is received at least ten (10) days prior to announced bid date and approved by addendum. Bidder shall state in writing any deviations from requirements and specifications. The casework shall conform to configuration, arrangement, design, material quality, joinery, panel thickness, and surfacing of that specified and shown on drawings.
- D. Manufacturers requesting approval shall submit samples with Cut-A-Ways showing cabinet construction, joinery, drawer and door construction, hardware, and materials; along with catalogs and specification in order that accurate evaluations can be made. Samples may be impounded for the duration of contract to insure construction specification compliance.

1.06 SUBMITTALS

- A. Shop drawings shall be submitted for approval within thirty (30) days after formal notification of award of contract. Drawings shall consist of floor plans indicating arrangement and relation to electrical, data technology and adjacent work and equipment, and complete elevations of casework. Centerline of service requirements shall be noted for use by other trades. A schedule of all sinks, fittings, and accessories that are part of this contract shall be provided.
- B. Color samples shall be submitted for selection and coordination at time of contract award. Samples of actual material and color shall be available as required.
- C. Additional catalog cuts, details and samples as requested by Architect for evaluation and coordination.
- D. Physical sample must be approved prior to fabrication.

1.07 PRODUCT DELIVERY AND STORAGE

- A. Protect cabinet and countertops during transit, delivery, storage and handling to prevent damage, soiling and deterioration.
- B. Store cabinets and countertops at project site installation and storage areas with similar ambient conditions as final installation. Storage areas must be kept dry, heated with low relative humidity and away from construction work such as painting, wet work, grinding and similar operations.

1.08 WARRANTY

- A. Casework manufacturer shall provide lifetime guarantee and limited warranty to the original Owner against defective material and fabrication for as long as they own the product - this is a warranty of replacement and repair only, the manufacturer will correct defects in material and/or fabrication without additional cost.
- B. Accessory equipment (sinks, fittings etc.) shall be warranted by appropriate manufacturer's guarantee.

PART 2 - PRODUCTS

2.01 CORE MATERIAL

- A. Cabinet components having particle board core material shall be of a minimum 45 lb. density, M-2 industrial grade. The particle board used shall have been tested under ANSI A208.1 1993 standards and/or ASTM D 1037-91A.
- B. Medium density fiberboard (MDF) shall be used in high stress areas as drawer members and shall be minimum 48 lb. density MD-21 grade and tested under ANSI A208.2 1994 Standards.
- C. Industrial hardboard shall be pre-finished 1/4" thickness composed of wood fibers, phenolic resin binders and moisture inhibitors that meet or exceed the hardboard product standard ANSI/AHA A135.4 1988.
- D. All countertops located with 3'-0" of any direction of built-in sink and/or bubblers shall be constructed of marine grade "Greenboard" MR moisture/water resistant particle board. The particle board shall be tested under ANSI A208.1 1-1993, M3 standards.

2.02 SURFACE MATERIAL

- A. Exposed exteriors shall be permanently thermofused melamine laminate, fused to core using a minimum average pressure of 320 PSI and average 320 degree F. temperature. Thermofused melamine laminate shall meet ALA 1996 specification standards, as tested against the high pressure laminate NEMA LD 3-1995, VGS.028 specification standards. (Warranted for life against delamination).
- B. Exposed doors and drawer fronts shall be permanently thermofused melamine laminate, fused to core using a minimum average pressure of 320 PSI and average 320 degree F. temperature. Thermofused melamine laminate shall meet ALA 1996 specification standards, as tested against the high pressure laminate NEMA LD 3-1995, VGS.028 specification standards, (Warranted for life against delamination).
- C. Exposed interiors shall be permanently thermofused

melamine laminate, fused to core using a minimum average pressure of 320 PSI and average 320 degree F. temperature. Thermofused melamine laminate shall meet ALA 1996 specification standards, as tested against the high pressure laminate NEMA LD 3-1995, VGS.028 specification standards. (Warranted for life against delamination).

- D. Semi-exposed and concealed surfaces shall be permanently thermofused melamine laminate or high pressure decorative plastic laminate cabinet liner, 0.020" thickness for balanced construction. Thermofused melamine laminate shall meet the ALA 1996 specifications standard, as tested against the high pressure laminate NEMA LD 3-1995, VGS.028 specification standards.

2.03 EDGINGS

- A. Exposed exterior cabinet front edges shall be banded with a contrasting or matching rigid PVC extrusion, 0.020" thickness, resistant to chip, crack and high impact. Edging shall have a satin finish with a UV cured top coat for additional durability. The 0.020" thick edging shall be applied with waterproof hot melt adhesive.
- B. Door and drawer front edges shall be banded with a contrasting or matching rigid PVC extrusion, 3mm (1/8") thickness, resistant to chip, crack, and high impact. Edging shall have a satin finish with UV cured top coat for additional durability. The 3mm thick edging shall be applied with waterproof hot melt adhesive, and shaped to provide radiused edges and radiused corners.
- C. Adjustable shelves shall be banded with PVC extrusion, resistant to chip, crack, and high impact. Edging shall have a satin finish with a UV cured top coat for additional durability. Edging shall be applied with waterproof hot melt adhesive. Shelves to be 1" thick. 0.020" thick PVC edging shall be applied to four (4) edges of adjustable shelf.
- D. All other interior components, including drawers, shall be banded with a PVC extrusion, 0.020" in thickness, resistant to chip, crack, and high impact. Edging shall have a satin finish with a UV cured top coat for additional durability. Edging to be machine applied with waterproof hot melt adhesive.

2.04 COLOR SELECTIONS

- A. Exposed cabinet exteriors shall be chosen from Thermofused melamine laminate selections as depicted in manufacturer's color selector guide. A minimum of seventy (70) colors and patterns shall be available as standard selection.
- B. Exposed doors and drawer fronts shall be chosen from Thermofused melamine laminate selections as depicted in manufacturer's color selector guide. A minimum of seventy (70) colors and patterns shall be available as standard selection.
- C. Semi-exposed surfaces, including drawer box components, shall be finished in either pearl or grey as selected from casework manufacturer's standard interior color selections.
- D. Exposed interior components, including both faces of shelves and interior face of backs to match exposed cabinet exterior color selection.
- E. Door and drawer front edges shall be chosen from one of twenty-two (22) trim group colors in 3mm thick PVC in contrasting or matching colors as depicted in manufacturer's color guide.
- F. Exposed front edge of cabinet, including exposed interior edges, shall be selected from one of seventy (70) trim group colors in 0.020" thick PVC in contrasting or matching colors as depicted in manufacturer's color guide, or commercial match to selected exposed exterior color based on availability.
- G. Semi-exposed edges of cabinet components including drawers, shall be either pearl or grey n 0.020" thick PVC.
- H. Pulls shall be available in chrome, brass, bent wire and injection molded pulls in either bent wire or contour design, to be available in twenty (20) colors as selected from manufacturer's color selector.
- I. Casework of substitute brands with lesser amounts or more restrictive selection requirements will not be considered equal and shall be rejected.
- J. Finishes to be laminate manufacturer's matte, suede, or

equivalent finish as approved by Architect. Samples will be reviewed by Architect for color, texture, and pattern only.

2.05 HARDWARE

A. Hinges

1. Institutional five-knuckle secured with minimum of eight screws. Hinge plate must extend into cabinet a minimum of 2 1/4" (56 mm) in order to assure maximum strength. Finish to be powder-coated baked on black enamel or brushed chrome US26D.

a. Two hinges used on all doors less than 48" (1220 mm) in height, three hinges used on all doors 48" (1220 mm) or greater in height. Hinge to accommodate 13/16" (21 mm) door.

B. Door catches shall be a heavy-duty spring loaded, large diameter (17.5mm - 11/16") roller type catch mounted at bottom edge. All doors over 48" in height shall be provided with roller catch at both top and bottom of door.

C. Catch strike plate shall be injection molded ABS, with an integrally molded engagement ridge. Strike plate shall also provide a wide face bumper insuring a positive door stop.

D. Pulls shall be impact resistant injection molded bent wire, 4" length available per color selection in Article 2.04.H.

E. Drawer and slide out shelves shall be suspended with bottom mount, side and bottom attached nylon roller epoxy coated steel slides to ensure quiet, smooth operation. Lateral stability is achieved thru a special formed captive profile. Slides shall have 100 lb. load rating, with both in and out drawer stop, 3" self close feature and a side adjustment cam allowing 3mm side to side alignment.

F. Drawers specifically noted for full extension file use shall be suspended with bottom mount, side and bottom attached nylon roller epoxy coated steel slides to ensure quiet, smooth operation. Lateral stability is achieved thru a special formed captive profile. Slides shall have 150 lb. load rating, with both in and out drawer stop, and 3" self close feature. File drawer shall include extruded

top mounted molded side rails to accept standard hanging file folders.

- G. Knee-space, pencil drawers, and keyboard trays, shall be designed to permit under counter or support frame mounting, with 100 lb. nylon roller epoxy coated steel slides.
- H. Hanger rods shall be heavy chrome plated tubing. Rod shall be securely affixed to cabinet shelves.
- I. Tote trays shall be of high impact polystyrene with smooth edges. Each tray to include an identification card holder and shall be suspended from rails securely attached to cabinet verticals.
- J. Shelf support clips for 1" thick adjustable shelves shall be injection molded clear polycarbonate. Support clips shall incorporate integral molded lock tabs to retain shelf from topping or inadvertently being lifted out. Support clip shall have 5mm dia. double pin engagement into precision bored hole pattern in cabinet vertical members. Clips shall have a molded ridge which provide pressure against edge of shelving to maintain positive pin engagement. Clip shall be designed in such a manner to provide means for permanent retention to shelf. Static test load must exceed 200lb. per clip.
- K. Dividers that are 1/4" thick shall be fully adjustable and retained with injection molded clear polycarbonate clip.
- L. Locks shall be cylinder type, diecast, with five (5) disc tumbler mechanism. Each lock shall be provided with milled brass key. Master key cabinets to room doors. Cabinets with multiple locks installed shall be keyed alike by room, with each cabinet in that room keyed the same unless otherwise specified. Locks shall be Remov-A-Core to give flexibility for different pass key options. Locks shall be provided on all cabinets capable of locking. Key all cabs and drawers within each room alike. Each room to be keyed differently. Provide 1 Master key for all locks. Note: Key each cabinet and drawer in Staff Lounge 152 differently with 1 Master key.
- M. Sliding door track shall be double channel rigid PVC

extrusion at both top and bottom of doors. Track shall be available in pearl, black or grey colors.

2.06 COMPONENTS

- A. Base, wall and tall cabinet ends shall be 3/4" thick particle board, laminated for balanced construction, surfaced as described in Article 2.02.A and edged as described in Article 2.03.A.
- B. Base and tall cabinet tops and bottoms shall be 3/4" thick particle board, laminated for balanced construction, surfaced as described in Article 2.02.C, and edged as described in Article 2.03.A.
- C. Wall cabinet top and bottom shall be 1" thick particle board, laminated for balanced construction, surfaced as described in Article 2.02.C, and edged as described in Article 2.03.A.
- D. Vertical cabinet members shall be 3/4" thick particle board, laminated for balanced construction, surfaced as described in Article 2.02.C, and edged as described in Article 2.03D.
- E. Cabinet backs shall be 1/4" thick pre-finished industrial hardboard.
- F. Frame rails shall be 3/4" thick x 3 3/4" wide particle board, laminated for balanced construction, surfaced as described in Article 2.02.C, and edged as described in Article 2.03.A.
- G. Sub base shall consist of two (2) toe kick support rails shall be 3/4" thick x 3 3/4" high particle board and be inset from cabinet front and back edge, to give additional load support.
- H. Mounting rails shall be 3/4" thick x 3 3/4" wide particle board. Wall cabinets shall have rails positioned at the top and bottom. Tall cabinets shall have rails positioned at the top and intermediate location. Base cabinet shall have rails positioned at the top of unit.
- I. Drawers shall be full box design with a separate front.

Drawer sides and ends shall be constructed of 5/8" medium density fiberboard with pearl or grey color thermofused melamine laminate and matching PVC top edges. Bottoms shall be 1/4" thick medium density fiberboard, pearl or grey color thermofused melamine laminate.

- J. Adjustable shelves shall be 1" thick. Edges of shelf shall be banded as described in Article 2.03.C with a high impact, rigid PVC extrusion, pearl or grey in color.
- K. Sliding display doors shall be constructed of 1/4" thick distortion free glazing sheet. Center edge shall be capped with full length aluminum channel. Aluminum channel shall be custom extruded, clear etched and anodized. Full length extruded aluminum channel shall be used on other edges.
- L. Solid hinged doors, sliding doors and drawer fronts shall be 3/4" thick material of balanced construction, surfaced as described in Section 2.02.B, edged as described in Article 2.03.B.

2.07 CONSTRUCTION

- A. Cabinet parts shall be accurately machined and precision bored for premium grade quality joinery construction, utilizing automatic machinery to ensure consistent sizing on modular cabinets. Cabinets shall be assembled under controlled case clamp conditions, assuring final cabinet squareness and proper joint compressions.
- B. Cabinet ends shall be bored to receive 8mm, industrial grade hardwood laterally fluted dowels with chamfered ends. Cabinet ends shall be prepared to receive adjustable shelf hardware at 32mm (approximately 1 1/4") centers. Door hinges and drawer slides shall be machined drilled to maintain vertical and horizontal alignment of components. Inset grooving with chamfer shall be machined 3/4" from rear edge to accept the 1/4" back. Base and tall units shall have one piece end panels continuous to floor for added load capabilities.
- C. Tops and bottoms shall be joined to cabinet ends using a minimum of six (6) dowels at each joint for twenty-four (24) inch deep cabinets and a minimum of four (4) dowels at each joint, for twelve (12) inch deep cabinets. All dowels to be industrial grade hardwood, laterally fluted, with chamfered ends and 8mm in diameter. Top of base cabinet will be full depth. Inset grooving with chamfer

shall be machined 3/4" from rear edge to accept the 1/4" back.

- D. Vertical dividers shall be bored to receive adjustable shelf hardware at 32 mm (approximately 1 1/4") centers. Dividers shall be joined to tops and bottoms with 8mm diameter hardwood dowels.
- E. Frame rails shall be joined to ends with 8mm diameter hardwood dowels.
- F. Two (2) toe kick supports shall be inset from cabinet front and back edges, and doweled into cabinet ends with 8mm hardwood dowels.
- G. Mounting rails shall be fully concealed behind backs. Rails shall be 3/4" thick and fastened to cabinet ends with 8mm hardwood dowels. Wall and tall cabinet shall incorporate two mounting rails. Wall cabinets shall have rails positioned at top and bottom. Tall cabinets shall have rails positioned at top and intermediate location. Base units shall have rail positioned in the upper back area.
- H. Back panels shall be 1/4" thick and inset 3/4" from rear edge of cabinet. Back shall be glued and continuously trapped in top, bottom and ends of cabinets.
- I. Drawer corner joints shall be interlocking dowel pin design. Hardwood dowel pins, 8mm diameter shall be inserted into drawer fronts and backs to fit into machined hole patterns in drawer sides. Bottoms shall be trapped into grooves on all four sides glued and mechanical fastened. Drawers shall be suspended on slides as described in Article 2.05.E.

2.08 WORK SURFACES

- A. Core material having particle board shall be of a minimum 45 lb. density, M-2 industrial grade. The particle board used shall have been tested under ANSI A208.1 1993 standards and/or ASTM D 1037-91A.
- B. Surface material shall be high pressure decorative plastic laminate thermoset to core using catalyzed PVA glue with a minimum average pressure of 90 PSI and average 180 degree F temperature. High pressure decorative plastic laminate shall meet NEMA LD 3-1995, HGP.039 specification standards.
- C. Color selection shall be high pressure decorative plastic

laminate selections as depicted in manufacturer's color selector guide. A minimum of seventy (70) colors and patterns shall be available as standard selection.

- D. Exposed edges shall be 90 degree plastic laminate with a chamfered edge.
- E. Underside of all work surfaces to have BK-20 backer or approved equivalent. This balance sheet shall be thermoset to core using catalyzed PVA glue with a minimum average pressure of 90 PSI and average 180 degree F. temperature.

F. Counter Tops - Plastic Laminate

- 1. Deck shall consist of two layers of 3/4" (19 mm) particle board at the front edge and all other exposed edges providing a total thickness of 1 1/2" (40 mm). Solid patterns or wood grain colors of ONLY WILSONART brand high-pressure plastic laminate may be selected for the surfaces. The method of application of the laminate to the substrate shall be as recommended by the Decorative Plastic Laminate Association.

- 2. Provide loose back splashes without scribes.

G. Physical Properties shall meet minimally:

1. Flexural Strength	ASTM-Method D-790	16,000/psi
2. Compressive Strength	ASTM-Method D-695	36,500/psi
3. Hardness Rockwell M	ASTM-Method D-785	110
4. Density Gr./CC.	ASTM-Method D-792	123.55 lbs/ft ³
5. Water Absorption	ASTM-Method D-570	0.0076%
6. Flame Test	ASTM-Method D-635	Self-Extinguishing

2.09 GLASS

- A. Wall unit full sliding glass doors: 1/4 inch laminated safety glass.
- B. Glass insert doors, hinged or sliding wall cabinets: 1/4 inch laminated safety glass.
- C. Glass insert doors, hinged or sliding tall or base cabinets. 1/4 inch laminate safety glass.
- D. Sliding doors mounted in aluminum track.
- E. Trim glass inserts: Extruded rigid PVC.

2.10 COLOR SELECTION

A. Laminate Color Selection:

1. Select from the full range of ONLY Wilsonart®, standard color charts for cabinet faces, exposed ends, open interiors and countertops.

B. Hinge and Pull Color Selection:

1. Select from full range of stock and custom colors to coordinate/match: Wilsonart®.

C. Miscellaneous Hardware Color Selection (support brackets, table frames, rail):

1. Select from full range of stock and custom colors to coordinate/match: Wilsonart®.

D. 3mm PVC Edge Banding Color Selection:

1. Select from full range of stock and custom colors to coordinate/match: Wilsonart®.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The Installer must examine the job site and the conditions under which the work in this section is to be performed, and notify the Construction Manager in writing of any unsatisfactory conditions. Do not proceed with work under this section until unsatisfactory conditions have been corrected in a manner acceptable to the installer.
- B. Casework, countertops, and related materials to be conditioned to average prevailing humidity condition in installation areas prior to start of work.
- C. Install casework and countertops with factory-trained supervision authorized by manufacturer. Casework shall be installed plumb, level, true and straight with no distortions. (Shim as required). Securely attached to building structure with anchorage devices of appropriate type, size and quantity to meet applicable codes, specifications and safety conditions. Where laminate clad casework and countertops abuts other finished work, scribe and trim to accurate fit.
- D. Adjust casework and hardware so that doors and drawers

operate smoothly without warp or bind. Lubricate operating hardware as recommended by the manufacturer.

- E. Repair, or remove and replace, defective work as directed upon completion of installation.
- F. Clean plastic surfaces, repair minor damage per plastic laminate manufacturer's recommendations. Replace other damaged parts of units.
- G. Advise Construction Manager of procedures and precautions for protection of casework and countertops from damage by other trades until acceptance of work by Owner.
- H. Cover casework with 4-mil polyethylene film for protection against soiling and deterioration during remainder of construction period.

END OF SECTION 12300

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**SECTION 20 0001
MECHANICAL DEMOLITION**

PART 1 GENERAL

1.01 SECTION INCLUDES

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 mechanical demolition as described in this specification and as shown and noted on the drawings.
- 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 conditions before submitting their bid.
- D. The contractor shall become familiar with the drawings and scope of work of other trades as the work scope of those trades relates to mechanical equipment and connection requirements.
- E. 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.
- F. During demolition the contractor shall record on site maintained as-builts of all hydronic system piping capped branches, plumbing sanitary, waste and domestic hot, cold and hot water recirculation capped branches, and capped supply air, return air and exhaust air ducts for reuse in renovated project space.

1.03 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: Contract descriptions, description of alterations work, work by others, future work, occupancy conditions, use of site and premises, work sequence.
- B. See Section 01 7419 - Construction Waste Management and Disposal.
- C. Section 02 4100 - Demolition: Selective demolition, site demolition, structure removal.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping and ductwork to be demolished serve only equipment and facilities within the demolition areas of the project.
- B. Report discrepancies to Owner before disturbing existing installation.
- C. Prior to the submission of a Request for Information (RFI) the contractor shall exhaust all efforts to remedy the situation in the field with the assistance of the construction manager (CM). The resolution shall be consistent with the means and methods described within both the drawings and specifications which constitute this contract. If review with the CM does not result in a resolution, it is then acceptable to submit a formal RFI to the architectural/engineering design team.
- D. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

- A. Identify locations for capping piping and ductwork before any demolition work commences.
- B. Confirm isolation valve locations for domestic water piping and hydronic piping. Repair leaking isolation valves or replace inoperable valves before commencing piping demolition.

- C. Cap and seal air-tight supply, return and exhaust air ductwork at shaft walls before commencing sheet metal demolition.

3.03 DEMOLITION OF EXISTING MECHANICAL WORK

- A. Remove, relocate and extend existing mechanical piping or sheet metal work to accomodate new construction.
- B. Remove sanitary and waste piping to branch connection fitting to negate any dead ends.
- C. Remove domestic water piping back to isolation valve.
- D. Remove all supply, return and exhaust air ductwork back to main connection.

3.04 CLEANING

- A. Clean and repair existing materials and equipment that remain or that are to be reused.

END OF SECTION

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, fire protection, 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. Demolition of mechanical equipment shall include all existing piping, valves, controls, supports and equipment where such items are not required for reuse. Mechanical equipment not specified for reuse shall be removed by the mechanical contractor from the site.
- B. Existing piping and ductwork: when encountered during the course of work, protect, brace and support existing piping and ductwork where required for proper execution of the work.
- C. Interruption of existing active piping and ductwork: when the course of work makes shut-down of services unavoidable, the mechanical contractor shall schedule the shut-down at such time as approved by the owners representative, which will cause least interference with established operating routine.
- D. Arrange work accordingly, providing such fittings as duct transitions traps, valves and accessories necessary to complete all construction in an orderly fashion.
- E. 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. Provide siphon on gages in steam systems.
- 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. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.
- H. 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. Celco
 - 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. Pipe hangers and supports.
 - 4. Valves.
 - 5. Flow controls.
 - 6. Strainers.

1.02 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.

1.03 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.

1.04 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.

1.05 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 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.

2.06 GATE VALVES

- A. Manufacturers:
 1. Conbraco Industries, Inc: www.apollovalves.com.
 2. Nibco, Inc: www.nibco.com.
 3. Milwaukee Valve Company: www.milwaukeevalve.com.
- B. Up To and Including 3 Inches:
 1. 1, Class 125, bronze body, bronze trim, rising stem, handwheel, inside screw, solid wedge disc, solder ends.
- C. 2 Inches and Larger:
 1. 1, Class 125, iron body, bronze trim, outside screw and yoke, handwheel, solid wedge disc, flanged ends. Provide chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.07 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 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 spring loaded check valves on discharge of water pumps.
- F. 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. Water hammer arrestors.
- F. 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. ASME A112.21.2M - Roof Drains; The American Society of Mechanical Engineers; 1983.
- C. ASSE 1013 - Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers; 2011.
- D. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2011.
- E. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).
- F. NSF 372 - Drinking Water System Components - Lead Content; 2011.
- G. PDI-WH 201 - Water Hammer Arresters; 2010.

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
- F. Cleanouts at Interior Unfinished Accessible Areas : Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.
 1. Zurn Industries, Inc.:

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 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.

2.06 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. 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. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Install floor cleanouts at elevation to accommodate finished floor.
- D. Install approved potable water protection devices where contamination of domestic water may occur; This includes fire sprinkler system.
- E. 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.
- F. Pipe relief from backflow preventer to nearest drain.
- G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatories, 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. UL 1453 - Standard for Electric Booster and Commercial Storage Tank Water Heaters; Current Edition, Including All Revisions.
- B. ANSI Z21.10.3
- C. CSA 4.3
- D. ASME, Section IV
- E. ANSI/ASHRAE 15-1994, Section 8.13.6
- F. 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 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.

2.03 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. 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. Urinals
- C. All-in-one lavatory system.
- D. Sinks
- E. Garbage Disposals

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 FLUSH VALVE WATER CLOSETS (WC-1)

- A. Bowl:
 - 1. Manufacturers:
 - a. Sloan
 - b. American Standard Inc.
 - c. Kohler.
 - d. Zurn.
 - 2. ASME A112.19.2M; wall hung, siphon jet vitreous china closet bowl, with elongated rim, 1-1/2 inch top spud, china bolt caps.
- B. Flush Valve Manufacturers:
 - 1. Delta Tech; Model 81T201
 - 2. Sloan Valve Company; Model "Optima Plus" 8111.

3. Zurn Industries, Inc..
- C. Battery Powered Sensor Operated Flush Valve:
 1. ASSE 1037, ANSI/ASME A112.19.6 and Military Specification V-29193. Chrome plated closet flushometer for either left or right hand supply, installation conforms to ADA requirements. Exposed, synthetic rubber diaphragm with dual filtered fixed bypass; battery powered infrared sensor with range adjustment; plastic cover assembly with integral window; indicator light and courtesy over-ride flush button; dual filtered by-pass; maximum 1.6 gallon flush volume; solid handle cap; 1" I.P.S. screwdriver angle stop; free spinning vandal resistant stop cap; vacuum breaker; spud coupling and flange for 1-1/2" top spud valve body.
- D. Seat:
 1. Manufacturers:
 - a. Beneke.
 - b. Church.
 - c. Centoco.
 - d. Zurn.
 - e. Substitutions: See Section 01600 - Product Requirements.
 2. Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, without cover.
- E. Water Closet Carrier:
 1. Manufacturers:
 - a. JOSAM Company.
 - b. MiFab
 - c. Wade
 - d. Watts Drainage; Model CA-101, CA-121 and/or CA-131.
 - e. Zurn Industries, Inc..
 - f. Jay R. Smith
 2. ASME A112.6.1M; adjustable cast iron frame, horizontal or vertical siphon jet, integral drain hub and 2" vent adjustable gasket face plate, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers, and rear anchor tie down and bonded neo-seal gasket.

2.03 WALL HUNG URINALS (UR-1)

- A. Wall Hung Urinal Manufacturers:
 1. Sloan.
 2. American Standard Inc.
 3. Kohler.
 4. Zurn.
- B. Urinals: Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.
 1. Flush Volume: 1.0 gallons, maximum.
 2. Flush Valve: Exposed (top spud).
 3. Flush Operation: Sensor operated.
 4. Trap: Integral.
- C. Urinal:
 1. ASME A112.19.2M; vitreous china, wall hung siphon jet flushing rim urinal with shields, integral trap, tamper proof removable stainless steel strainer, top spud, steel supporting hanger.
- D. Flush Valve Manufacturers:
 1. Delta Teck 81T231BT.
 2. Sloan Valve Company.
 3. Zurn Industries, Inc: www.zurn.com.
 4. ASME A112.18.1M; exposed chrome plated, diaphragm type with oscillating handle, escutcheon, integral screwdriver stop, vacuum breaker; maximum 1 gallon flush volume.

5. ASME A112.18.1M; concealed rough brass, diaphragm type with exposed chrome plated push button and escutcheon, wheel handle stop and vacuum breaker; maximum 1 gallon. flush volume.
- E. Battery Powered Sensor Operated Flush Valve:
 1. ASSE 1037, ANSI/ASME A112.19.6 and Military Specification V-29193. Chrome plated closet flushometer for either left or right hand supply, installation conforms to ADA requirements. Exposed, synthetic rubber diaphragm with dual filtered fixed bypass; battery powered infrared sensor with range adjustment; plastic cover assembly with integral window; indicator light and courtesy over-ride flush button; dual filtered bypass; maximum 1.0 gallon flush volume; solid handle cap; 3/4" I.P.S. screwdriver angle stop; free spinning vandal resistant stop cap; vacuum breaker; spud coupling and flange for 3/4" top spud valve body.
 2. ASME A112.18.1M; exposed chrome plated, porous felt type for 1/2 inch supply with oscillating handle, screwdriver stop and vacuum breaker.
- F. Carriers:
 1. Manufacturers:
 - a. JOSAM Company; _____: www.josam.com.
 - b. MiFab.
 - c. J.R. Smith.
 - d. Wade.
 - e. Watts Drainage.
 - f. Zurn Industries, Inc: www.zurn.com.
 2. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

2.04 WALL-HUNG MULTI-STATION LAVATORY UNITS (WF-1):

- A. Description: Rectilinear, level-surface deck, seamless and integral elongated basin, with stainless steel enclosed pedestal cabinet.
- B. Deck and Bowl Material: Fabricate from molded engineered stone material consisting of natural quartz, granite, and other minerals in a matrix of thermoset acrylic modified bio-based polyester resin and meeting requirements of IAPMO Z124.
- C. Surface Burning Characteristics: Smoke developed index less than 450, and flame spread index less than 25, Class A, when tested in accordance with ASTM E84.
- D. Number of Wash Stations: Two.
- E. Soap Dispenser:
 1. Deck-mounted, sensor-operated, chrome-plated plastic, with LED battery and soap level indicators, battery box and batteries and 27 ounce (798 ml) bottle of 1000 shot soap.
- F. Color: As selected by Architect from manufacturer's full line.
- G. Faucet Drilling: 4 inch (100 mm) centerset drilling.
- H. Access Panel: Stainless steel.
- I. Support Frame: Wall mounted, heavy gage, stainless steel.

2.05 SINKS (SK-1)

- A. Manufacturers:
 1. American Standard.
 2. Just.
 3. Elkay.
- B. Double Compartment Bowl: ADA Compliant
 1. ASME A112.19.3M; 20 gage thick, Type 304 stainless steel, self-rimming and undercoated, with ledge back drilled for trim.
 - a. Drain: 3 1/2 chromed brass drain.
- C. Supply Faucet Manufacturers:

1. Elkay.
 2. Kohler.
 3. Delta
 4. Just
- D. Supply Faucet:
- 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 Model "LC-50"

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.

3.08 SCHEDULES

- A. Fixture Heights: Install fixtures to heights above finished floor as indicated.
 - 1. Water Closet:
 - a. Standard: 15 inches to top of bowl rim.
 - b. Accessible: 18 inches to top of seat.
 - 2. Urinal:
 - a. Standard: 22 inches to top of bowl rim.
 - b. Accessible: 17 inches to top of bowl rim.
 - 3. Lavatory:
 - a. Standard: 31 inches to top of basin rim.
 - b. Accessible: 34 inches to top of basin rim.
- B. Fixture Rough-In
 - 1. Water Closet (Flush Valve Type): WC-1
 - a. Cold Water: 1 Inch.
 - b. Waste: 4 Inch.
 - c. Vent: 2 Inch.
 - 2. Urinal (Flush Valve Type): UR-1
 - a. Cold Water: 3/4 Inch.
 - b. Waste: 2 Inch.
 - c. Vent: 1-1/2 Inch.
 - 3. Sink: SK-1
 - a. Hot Water: 1/2 Inch.
 - b. Cold Water: 1/2 Inch.
 - c. Waste: 1-1/2 Inch.
 - d. Vent: 1-1/2 Inch

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 3100
HVAC DUCTS AND CASINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single-wall rectangular ducts and fittings.
- B. Single-wall round ducts and fittings.
- C. Sheet metal materials.
- D. Sealants and gaskets.
- E. Hangers and supports.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.
- C. Section 23 3300 - Air Duct Accessories.
- D. Section 23 3700 - Air Outlets and Inlets.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- B. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2016.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- D. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2014.
- E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.
- G. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2012, 2nd Edition.
- H. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.
- I. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

1.04 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.

1.05 SUBMITTALS

- A. Product Data: Provide data for duct materials, 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.

1.06 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 SINGLE-WALL ROUND DUCT AND FITTING ASSEMBLIES

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. McGill AirFlow LLC.
 - b. Spiral Manufacturing Co., Inc.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round 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."
 - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round 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."
 - 1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," 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."

2.03 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.
- D. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
- E. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- F. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.04 SEALANTS AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
 - 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 - 2. Tape Width: 3 inches.
 - 3. Sealant: Modified styrene acrylic.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 - 7. Service: Indoor and outdoor.
 - 8. Service Temperature: Minus 40 to plus 200 deg F.
 - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
 - 10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 11. Sealant 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."
- C. Water-Based Joint and Seam Sealant:
 - 1. Application Method: Brush on.
 - 2. Solids Content: Minimum 65 percent.
 - 3. Shore A Hardness: Minimum 20.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. VOC: Maximum 75 g/L (less water).

7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 8. Service: Indoor or outdoor.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
 2. Type: S.
 3. Grade: NS.
 4. Class: 25.
 5. Use: O.
 6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 7. Sealant 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."
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- F. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for

2.05 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.

2.06 DUCTWORK FABRICATION

- A. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Provide turning vanes in all mitered elbows.
- C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.
- 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.

2.07 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. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- H. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."
- L. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- M. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- N. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.
- O. Use double nuts and lock washers on threaded rod supports.

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 SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 2. Outdoor, Exhaust Ducts: Seal Class C.
 - 3. Unconditioned Space, Exhaust Ducts: Seal Class C.

3.04 DUCT CLEANING

- A. Clean new duct system(s) before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.
 - 1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
 - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 - 3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Particulate Collection and Odor Control:
 - 1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
 - 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
- D. 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.
- E. 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.

3.05 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.

3.06 SCHEDULES

- A. 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.
- B. 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."
- 2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. 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."
- 3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90 degree elbow.
 - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90 degree elbow.
 - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90 degree elbow.
 - 4) Radius-to Diameter Ratio: 1.5.
 - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 Inches and Larger in Diameter: Welded.
- C. 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. Backdraft dampers - fabric.
- D. Duct access doors.
- E. Duct test holes.
- F. Flexible duct connections.
- G. 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 - METAL

2.03 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.

2.04 BACKDRAFT DAMPERS - FABRIC

- A. Fabric Backdraft Dampers: Factory-fabricated.
 - 1. Blades: Neoprene coated fabric material.
 - 2. Birdscreen: 1/2 inch nominal mesh of galvanized steel or aluminum.
 - 3. Maximum Velocity: 1000 fpm (5 m/sec) face velocity.

2.05 DUCT ACCESS DOORS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.

2.06 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.

2.07 FLEXIBLE DUCT CONNECTIONS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.
- B. Flexible Duct Connections: Fabric crimped into metal edging strip.

2.08 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. Inline centrifugal 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 INLINE CENTRIFUGAL 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. 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. Hung Cabinet Fans:
 - 1. Install fans with resilient mountings and flexible electrical leads. Refer to Section 22 0548.
 - 2. Install flexible connections specified in Section 23 3300 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.
- C. Provide sheaves required for final air balance.
- 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. Registers/grilles.
- B. Door grilles.
- C. Louvers.

1.02 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.03 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Krueger: www.krueger-hvac.com.
- B. Price Industries: www.price-hvac.com.
- C. Titus: www.titus-hvac.com.

2.02 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

- A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees, vertical face.
- B. Frame: 1-1/4 inch margin with countersunk screw mounting.
- 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 where not individually connected to exhaust fans.

2.03 CEILING EGG CRATE EXHAUST AND RETURN GRILLES

- A. Type: Egg crate style face consisting of 1/2 x 1/2 x 1/2 inch, 1/2 x 1/2 x 1 inch, and 1 x 1 x 1 inch grid core.
- B. Fabrication: Grid core consists of aluminum with mill aluminum finish.
- C. Frame: 1-1/4 inch margin with countersunk screw mounting.

2.04 DOOR GRILLES

- A. Type: V-shaped louvers of 20 gage, 0.0359 inch thick steel, 1 inch deep on 1/2 inch centers.
- B. Frame: 20 gage, 0.0359 inch steel with auxiliary frame to give finished appearance on both sides of door, with factory prime coat finish.

2.05 LOUVERS

- A. Type: 4 inch deep with blades on 45 degree slope with center baffle and return bend, heavy channel frame, 1/2 inch square mesh screen over exhaust and 1/2 inch square mesh screen over intake.
- B. Fabrication: 16 gage, 0.0598 inch thick galvanized steel welded assembly, with factory prime coat finish.
- C. Mounting: Furnish with interior flat flange for installation.

2.06 INTAKE AND RELIEF LOUVERS

- A. Louver Manufacturers:
 - 1. Greenheck.
 - 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: 6 inches.
 - d. Downspouts and caulking surfaces.
 - 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: 6 inches.
 - 3. Bird Screen:
 - a. Material: Aluminum, 3/4 inch x 0.51 inch expanded, flattened.
 - b. Frame: Removeable, rewireable.
 - 4. Gutters: Drain gutters in head frame at each blade.
 - 5. Downspouts: Downspouts in jambs to drain water from louver for minimum water cascade from blade to blade.
 - 6. Vertical Supports: Hidden vertical supports to allow continuous line appearance up to 120 inches.
 - 7. Sill: Steeply angles integral sill eliminating areas of standing or trapped moisture where mold or mildew may thrive and effect indoor air quality.
 - 8. 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. Accessories:
 - 1. Insect Screen: Aluminum mech construction.
- F. 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. 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 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. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide typical catalog of information including arrangements.
- C. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.
- D. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

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.
 - 4. Marley Engineered Products.
- 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.
- F. Units with Electric Heating Elements:
 1. Install as indicated including electrical devices furnished by manufacturer but not factory installed.
 2. Install wiring in accordance with the manufacturer's wiring diagram submittal and Section 26 2717.

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

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. Panelboards
 - 2. Disconnect Switches
 - 3. Time Switches
 - 4. Wiring Devices
 - 5. Lighting Fixtures
 - 6. Fire Alarm System
 - 7. Handholes

8. 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.
- 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. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
 - 1. PCB-containing electrical equipment, including transformers, capacitors, and switches.
 - 2. PCB- and DEHP-containing lighting ballasts.
 - 3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned wiring to source of supply.

- D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
- E. 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.
- F. Disconnect and remove abandoned panelboards and distribution equipment.
- G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
- I. Repair adjacent construction and finishes damaged during demolition and extension work.
- J. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
- K. 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.
- C. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

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. Power and control tray cable.
- C. Wiring connectors.
- D. Electrical tape.
- E. Heat shrink tubing.
- F. Wire pulling lubricant.
- G. 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 28 3100 - Fire Detection and Alarm: Fire alarm system conductors and cables.

1.03 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013.
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011.
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010 (Reapproved 2014).
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2014).
- E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2010.
- F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2013.
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- H. NEMA WC 70 - Nonshielded Power Cable 2000 V or Less for the Distribution of Electrical Energy; 2009.
- I. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.
- J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.
- L. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.
- M. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.
- N. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.
- O. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

- P. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.
- Q. UL 1277 - Electrical Power and Control Tray Cables with Optional Optical-Fiber Members; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
 - 3. Notify 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 conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
- C. Manufactured Wiring System Shop Drawings: Provide plan views indicating proposed system layout with components identified; indicate branch circuit connections.

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.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify 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.
- C. Nonmetallic-sheathed cable is not permitted.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- D. Comply with NEMA WC 70.
- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

- F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- G. Conductors for Grounding and Bonding: Also comply with Section 26 0526.
- H. Conductor Material:
 - 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
 - 2. Provide copper conductors except where aluminum conductors are specifically indicated. Substitution of aluminum conductors for copper is not permitted. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
 - 3. Provide copper conductors except where aluminum conductors are specifically indicated or permitted for substitution. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
 - 4. 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.
 - 5. Tinned Copper Conductors: Comply with ASTM B33.
- I. 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.
- J. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- K. Conductor Color Coding:
 - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 - 2. Color Coding Method: Integrally colored insulation.
 - 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. 240/120 V High-Leg Delta, 3 Phase, 4 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B (High-Leg): Orange.
 - 3) Phase C: Blue.
 - 4) Neutral/Grounded: White.
 - c. Equipment Ground, All Systems: Green.

2.03 SINGLE CONDUCTOR BUILDING WIRE

- A. Description: Single conductor insulated wire.
- B. Conductor Stranding:
 - 1. Feeders and Branch Circuits:
 - a. Size 10 AWG and Smaller: Solid.
 - b. Size 8 AWG and Larger: Stranded.
- C. Insulation Voltage Rating: 600 V.
- D. 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.

2.04 POWER AND CONTROL TRAY CABLE

- A. Description: NFPA 70, Type TC cable listed and labeled as complying with UL 1277.
- B. Conductor Stranding: Stranded.
- C. Insulation Voltage Rating: 600 V.
- D. Insulation: Type XHHW or XHHW-2.
- E. Jacket: PVC or Chlorinated Polyethylene (CPE).

2.05 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Connectors for Grounding and Bonding: Comply with Section 26 0526.
- C. 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.
- D. Wiring Connectors for Terminations:
 - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
 - 2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
 - 3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
 - 4. 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.
- E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.
- G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
- H. Mechanical Connectors: Provide bolted type or set-screw type.
- I. Compression Connectors: Provide circumferential type or hex type crimp configuration.

2.06 WIRING ACCESSORIES

- A. Electrical Tape:
 - 1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
 - 2. 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.
 - 3. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
 - 4. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.

- B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
- C. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
- D. Cable Ties: Material and tensile strength rating suitable for application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that field measurements are as shown on the drawings.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

- A. Circuiting Requirements:
 - 1. Unless dimensioned, circuit routing indicated is diagrammatic.
 - 2. When circuit destination is indicated and routing is not shown, determine exact routing required.
 - 3. Arrange circuiting to minimize splices.
 - 4. Include circuit lengths required to install connected devices within 10 ft of location shown.
 - 5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
 - 6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
 - 7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are shown as separate, combining them together in a single raceway is not permitted.
 - 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.
 - d. _____.
 - 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.
- B. Install products in accordance with manufacturer's instructions.
- C. Install conductors and cable in a neat and workmanlike manner in accordance with NECA 1.
- D. 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.
- E. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- F. 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.
- G. Terminate cables using suitable fittings.
 1. Metal-Clad Cable (Type MC):
 - a. Use listed fittings.
 - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
- H. Install conductors with a minimum of 12 inches of slack at each outlet.
- I. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- J. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- K. 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.
- L. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
 1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
 - a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
- M. Insulate ends of spare conductors using vinyl insulating electrical tape.
- N. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- O. Identify conductors and cables in accordance with Section 26 0553.
- P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- Q. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 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. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
- E. Correct deficiencies and replace damaged or defective conductors and cables.

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.

1.02 RELATED REQUIREMENTS

- A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
- B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- B. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 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.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

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. Bonding and Equipment Grounding:
 - 1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical

conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.

2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.

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.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as shown on the drawings.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install grounding and bonding system components in a neat and workmanlike manner in accordance with NECA 1.
- C. Make grounding and bonding connections using specified connectors.
 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

- D. Identify grounding and bonding system components in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.13.
- D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION

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 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 05 5000 - Metal Fabrications: Materials and requirements for fabricated metal supports.
- C. Section 26 0534 - Conduit: Additional support and attachment requirements for conduits.
- D. Section 26 0537 - Boxes: Additional support and attachment requirements for boxes.
- E. Section 26 5100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.
- F. Section 26 5600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.
- G. Construction requirements for concrete bases

1.03 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.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - 5. Notify 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.

1.05 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.

1.06 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.

1.07 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with applicable building code.
- C. Installer Qualifications for Field-Welding: As specified in Section 05 5000.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
- B. Conduit hangers and supports shall have the manufacturer's name and part number stamped on the part for identification.
- C. Manufacturer: Company specializing in manufacturing products specified in this section with a minimum of five years documented experience in the industry, and certified ISO 9000.

1.09 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. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
 6. 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. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch.
 4. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.
 5. 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. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
 3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
 4. Hollow Masonry: Use toggle bolts.
 5. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
 - a. Comply with MFMA-4.
 - b. Channel Material: Use galvanized steel.
 - c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
 6. 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 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install support and attachment components in a neat and workmanlike manner in accordance with NECA 1.
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- D. Unless specifically indicated or approved by 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. Conduit Support and Attachment: Also comply with Section 26 0534.
- I. Box Support and Attachment: Also comply with Section 26 0537.
- J. Interior Luminaire Support and Attachment: Also comply with Section 26 5100.
- K. Exterior Luminaire Support and Attachment: Also comply with Section 26 5600.
- L. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.
- M. Secure fasteners according to manufacturer's recommended torque settings.
- N. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect support and attachment components for damage and defects.
- C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- D. Correct deficiencies and replace damaged or defective support and attachment components.
- E. Mounting and Anchorage of surface-mounted equipment and components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To wood: Fasten with lag screws or through bolts.
 - 2. To new concrete: Bolt to concrete inserts

3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4-inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
5. To Steel: Beam clamps (MSS type 19,21,23,25,or 27) complying with MSS SP-69.
6. To light steel: Sheet metal screws.

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 0519 - Low-Voltage Electrical Power Conductors and Cables: Metal clad cable (Type MC), armored cable (Type AC), and manufactured wiring systems, including uses permitted.
- C. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- D. Section 26 0529 - Hangers and Supports for Electrical Systems.
- E. Section 26 0553 - Identification for Electrical Systems.
- F. Section 26 0537 - Boxes.
- G. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- H. Section 31 2316 - Excavation.
- I. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.
- J. Section 31 2323 - Fill: Bedding and backfilling.

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. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
 - 3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
 - 4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
 - 5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
 - 6. 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.
 - 7. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges 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 Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- F. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- G. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- H. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
 - 1. Locations subject to physical damage include, but are not limited to:
 - a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
- 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. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
 - 1. Maximum Length: 6 feet.
- L. Connections to Vibrating Equipment:
 - 1. Dry Locations: Use flexible metal conduit.
 - 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
 - 3. Maximum Length: 6 feet unless otherwise indicated.
 - 4. Vibrating equipment includes, but is not limited to:
 - a. Transformers.
 - b. Motors.
- M. Fished in Existing Walls, Where Necessary: Use flexible metal conduit.

2.02 CONDUIT REQUIREMENTS

- A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.
- 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. Minimum Conduit Size, Unless Otherwise Indicated:
 - 1. Branch Circuits: 1/2 inch (16 mm) trade size.
 - 2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
 - 3. Control Circuits: 1/2 inch (16 mm) trade size.
 - 4. Flexible Connections to Luminaires: 3/8 inch (12 mm) trade size.
- E. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 - 1. Allied Tube & Conduit: www.alliedeg.com.
 - 2. Republic Conduit: www.republic-conduit.com.
 - 3. Wheatland Tube Company: www.wheatland.com.
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- C. Fittings:
 - 1. Manufacturers:
 - a. Bridgeport Fittings Inc: www.bptfittings.com.
 - 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. Material: Use steel or malleable iron.
 - 4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 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. Material: Use aluminum.
 - 4. 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. Material: Use steel or malleable iron.
 - 3. 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. 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 LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- C. Fittings:
 - 1. Manufacturers:
 - a. Bridgeport Fittings Inc: www.bptfittings.com.
 - b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
 - c. Thomas & Betts Corporation: www.tnb.com.
 - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

3. Material: Use steel or malleable iron.

2.08 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. Manufacturers:
 - a. Bridgeport Fittings Inc: www.bptfittings.com.
 - b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 3. Material: Use steel or malleable iron.
 4. Connectors and Couplings: Use compression (gland) or set-screw type.
 - a. Do not use indenter type connectors and couplings.
- 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 Routing:
 - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
 - 2. Conceal all conduits unless specifically indicated to be exposed.
 - 3. Arrange conduit to maintain adequate headroom, clearances, and access.
 - 4. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
 - 5. Arrange conduit to provide no more than 150 feet between pull points.
 - 6. Route conduits above water and drain piping where possible.
 - 7. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
 - 8. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
- I. 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.
 - 3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
 - 4. Use conduit strap to support single surface-mounted conduit.
 - a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
 - 5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
 - 6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
 - 7. Use of wire for support of conduits is not permitted.
 - a. For securing conduits to studs in hollow stud walls.
 - b. For suspending conduits supported by spring steel conduit clips (only where specifically indicated or permitted).
- J. 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.
- K. 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. Provide suitable modular seal where conduits penetrate exterior wall below grade.
 7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
 8. 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.
 9. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- L. Underground Installation:
 1. Provide trenching and backfilling in accordance with Section 31 2316.13.
 2. Provide trenching and backfilling in accordance with Section 31 2316 and Section 31 2323.
 3. Minimum Cover, Unless Otherwise Indicated or Required:
 - a. Underground, Exterior: 24 inches.
 - b. Under Slab on Grade: 12 inches to bottom of slab.
 - c. _____.
- M. 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.
- N. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
 1. Where conduits pass from outdoors into conditioned interior spaces.
 2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- O. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.
- P. Provide grounding and bonding in accordance with Section 26 0526.
- Q. Identify conduits in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 26 0535
SURFACE RACEWAYS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface raceway systems.
- B. Wireways.

1.02 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.

1.03 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. UL 5 - Surface Metal Raceways and Fittings; Current Edition, Including All Revisions.
- D. UL 870 - Wireways, Auxiliary Gutters, and Associated Fittings; Current Edition, Including All Revisions.

1.04 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.

1.05 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.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

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. Surface Metal Raceways: Listed and labeled as complying with UL 5.
- B. Surface Raceway System:
 - 1. Raceway Type: Single channel, painted steel.
 - 2. Color: To be selected by Architect.
 - 3. Accessory Device Boxes: Suitable for the devices to be installed; color to match raceway.

2.03 WIREWAYS

- A. Description: Lay-in wireways and wiring troughs with removable covers; listed and labeled as complying with UL 870.
- B. Wireway Type, Unless Otherwise Indicated:
- C. 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 outlet boxes and conduit terminations are installed in proper locations and are properly sized in accordance with NFPA 70 to accommodate raceways.
- B. Verify that mounting surfaces are ready to receive raceways and that final surface finishes are complete, including painting.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install 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.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect raceways for damage and defects.
- C. 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 08 3100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.
- C. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- D. Section 26 0529 - Hangers and Supports for Electrical Systems.
- E. Section 26 0535 - Surface Raceways:
 - 1. Accessory boxes designed specifically for surface raceway systems.
 - 2. Lay-in wireways and wiring troughs with removable covers.
- F. 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 placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify 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 Locations:
 1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 3100 as required where approved by the Architect.
 2. Unless dimensioned, box locations indicated are approximate.
 3. Locate boxes so that wall plates do not span different building finishes.
 4. Locate boxes so that wall plates do not cross masonry joints.
- E. 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.
- F. Install boxes plumb and level.
- G. 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.
- H. Install boxes as required to preserve insulation integrity.
- I. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- J. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- K. Close unused box openings.
- L. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- M. 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 0553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Voltage markers.
- E. Warning signs and labels.
- F. Field-painted identification of conduit.

1.02 RELATED REQUIREMENTS

- A. Section 09 9123 - Interior Painting.
- B. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

1.03 REFERENCE STANDARDS

- A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011.
- B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide catalog data for nameplates, labels, and markers.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

- A. Identification for Equipment:
 - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
- B. Identification for Conductors and Cables:
 - 1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
 - 2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
 - 1. Materials:
 - 2. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.
- B. Identification Labels:

1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
 2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Nameplates: Engraved three-layer laminated plastic, black letters on white background.
- D. Labels: Embossed adhesive tape, with 3/16 inch white letters on black background. Use only for identification of individual wall switches and receptacles, control device stations, and

2.03 WIRE AND CABLE MARKERS

- A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
- B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- C. Legend: Power source and circuit number or other designation indicated.
- D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
- E. Minimum Text Height: 1/8 inch.
- F. Color: Black text on white background unless otherwise indicated.
- G. Description: Vinyl cloth type self-adhesive wire markers.

2.04 VOLTAGE MARKERS

- A. Minimum Size:
- B. Legend:
- C. Color: Black text on orange background unless otherwise indicated.

2.05 WARNING SIGNS AND LABELS

- A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- B. Warning Signs:
1. Materials:
 2. Minimum Size: 7 by 10 inches unless otherwise indicated.
- C. Warning Labels:
1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
 2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
 3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.
- B. Degrease and clean surfaces to receive nameplates and labels.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
1. Surface-Mounted Equipment: Enclosure front.
 2. Flush-Mounted Equipment: Inside of equipment door.
 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.

4. Elevated Equipment: Legible from the floor or working platform.
 5. Interior Components: Legible from the point of access.
 6. Conductors and Cables: Legible from the point of access.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

END OF SECTION

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-inrush 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. Separate 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 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. 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.
- 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. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

- E. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- 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. Panelboard Keys: Two of each different key.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

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:
- D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
 - 1. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
- G. Conductor Terminations: Suitable for use with the conductors to be installed.
- H. 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:
 - 2. Boxes: Galvanized steel unless otherwise indicated.
 - a. Provide wiring gutters sized to accommodate the conductors to be installed.
 - 3. Fronts:
 - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
 - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
 - 4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- I. 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.

2.04 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. Provide clear plastic circuit directory holder mounted on inside of door.

2.05 OVERCURRENT PROTECTIVE DEVICES

- A. Molded Case Circuit Breakers:
 1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
 2. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
 - 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.

END OF SECTION

SECTION 26 2717
EQUIPMENT WIRING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

- A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.
- B. Section 26 0534 - Conduit.
- C. Section 26 0537 - Boxes.
- D. Section 26 2726 - Wiring Devices.
- E. Section 26 2818 - Enclosed Switches.
- F. Section 26 2913 - Enclosed Controllers.

1.03 REFERENCE STANDARDS

- A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).
- B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
 - 2. Determine connection locations and requirements.
- B. Sequencing:
 - 1. Install rough-in of electrical connections before installation of equipment is required.
 - 2. Make electrical connections before required start-up of equipment.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide wiring device manufacturer's catalog information showing dimensions, configurations, and construction.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
 - 1. Colors: Conform to NEMA WD 1.
 - 2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.

- 3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
- B. Disconnect Switches: As specified in Section 26 2818 and in individual equipment sections.
- C. Wiring Devices: As specified in Section 26 2726.
- D. Flexible Conduit: As specified in Section 26 0534.
- E. Wire and Cable: As specified in Section 26 0519.
- F. Boxes: As specified in Section 26 0537.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Provide receptacle outlet to accommodate connection with attachment plug.
- E. Provide cord and cap where field-supplied attachment plug is required.
- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

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.

1.02 RELATED REQUIREMENTS

- A. Section 09 6900 - Access Flooring.
- B. Section 26 0537 - Boxes.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

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. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).
- E. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.
- H. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.
- I. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.
- J. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.
- K. 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 installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
 - 4. 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. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
 - 1. Wall Dimmers: Include derating information for ganged multiple devices.

- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Operation and Maintenance Data:
 - 1. Wall Dimmers: Include information on operation and setting of presets.
 - 2. GFCI Receptacles: Include information on status indicators.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

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. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
- D. Provide GFCI protection for receptacles installed within 6 feet of sinks.
- E. Provide GFCI protection for receptacles serving electric drinking fountains.

2.03 WIRING DEVICE FINISHES

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Wiring Devices, Unless Otherwise Indicated: White with stainless steel wall plate.
- C. Wiring Devices Installed in Finished Spaces: White with white nylon wall plate.

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. 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.
- B. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
- 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. 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.
- B. Convenience Receptacles:
 - 1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
- C. GFCI Receptacles:
 - 1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.

2.08 WALL PLATES

- A. 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.
- B. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.
- C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

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. 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.
- 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. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- J. Install wall switches with OFF position down.
- K. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- L. Do not share neutral conductor on branch circuits utilizing wall dimmers.
- M. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
- N. 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.
- O. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

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.

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 2 PRODUCTS

1.01 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. Short Circuit Current Rating:
- F. Conductor Terminations: Suitable for use with the conductors to be installed.
- G. Enclosures:
 - 1. Comply with NEMA ICS 6.
 - 2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - 3. Finish: Manufacturer's standard unless otherwise indicated.
- H. Instrument Transformers:
 - 1. Comply with IEEE C57.13.
 - 2. Select suitable ratio, burden, and accuracy as required for connected devices.
 - 3. Current Transformers: Connect secondaries to shorting terminal blocks.
 - 4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

1.02 OVERCURRENT PROTECTIVE DEVICES

- A. Overload Relays:
 - 1. Provide overload relays and, where applicable, associated current elements/heaters, selected according to actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.
 - 2. Inverse-Time Trip Class Rating: Class 20 unless otherwise indicated or required.
 - 3. Trip-free operation.
 - 4. Visible trip indication.
 - 5. Resettable.
 - a. Employ manual reset unless otherwise indicated.
 - b. Do not employ automatic reset with two-wire control.

END OF SECTION

SECTION 26 5100
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior luminaires.
- B. Emergency lighting units.
- C. Exit signs.
- D. Ballasts and drivers.
- E. Lamps.
- F. Luminaire accessories.

1.02 RELATED REQUIREMENTS

- A. Section 26 0537 - Boxes.
- B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 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. 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; 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 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.
- I. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.
- J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. NFPA 101 - Life Safety Code; 2015.
- L. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
- M. UL 1598 - Luminaires; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
 - 2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
 - 3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.

4. Notify 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.
- 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, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
 1. LED Luminaires:
 - a. Include estimated useful life, calculated based on IES LM-80 test data.
 - b. Include IES LM-79 test report upon request.
 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.
- 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. Ballast product specification sheet from manufacturer.

1.06 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.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 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.

1.10 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide three year manufacturer warranty for all LED luminaires, including drivers.
- C. Provide five year pro-rata warranty for batteries for emergency lighting units.
- D. Provide ten year pro-rata warranty for batteries for self-powered exit signs.
- E. Provide three year full warranty for fluorescent emergency power supply units.

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 EMERGENCY LIGHTING UNITS

- A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
- B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
- C. Battery:
 - 1. Sealed maintenance-free nickel cadmium unless otherwise indicated.
 - 2. Size battery to supply all connected lamps, including emergency remote heads where indicated.
- D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
- E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

3.04 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.

3.05 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.

3.06 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. Emergency Lighting Units:
 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
- K. 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.
- L. 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. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.
- E. 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. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Strategic Energy Solutions, Inc. or authority having jurisdiction.
- C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by 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.

4.07 ATTACHMENTS

- A. Luminaire schedule.

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 contractors 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